MASTER THESIS REPORT

A strategy towards integrating sustainability into the procurement practices in projects

Developing a sustainability framework for EPC companies

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M.Sc. Construction Management and Engineering

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Delft University of Technology

A strategy towards integrating sustainability into the procurement practices in projects

Developing a sustainability framework for EPC companies

In partial fulfilment of the requirements for the degree of
Master of Science in Construction Management and Engineering
at **Delft University of Technology**

In collaboration with **Fluor Consultants B.V**.

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PREFACE

"Begin with the end in mind"

This graduation thesis titled "A strategy towards integrating sustainability into the procurement practices in projects: Developing a sustainability framework for EPC companies" marks the final step of my journey towards the Master of Science degree in Construction Management and Engineering at Delft University of Technology. I faced many challenges during the past eight months of my research, but with hard work, determination and focus I was able to overcome all obstacles and maintain my passion for the topic of sustainability and achieve my end goal. I learned a lot during this journey, and I believe I have been able to positively develop myself both personally and professionally.

But without the help of several people, this journey would not have been possible. First and foremost, I would like to express my sincere gratitude to my graduation committee for their assistance and guidance throughout the graduation process. Thank you to my first supervisor, Dr. ir. Maedeh Molaei, for always taking the time to help when I was uncertain how to proceed and providing the feedback necessary to guide me to the finish. Thank you also for all the feedback and comments on my report, helping me better structure my report. Thank you to my graduation chair, Dr. ir. Ad Straub, for always keeping a positive attitude throughout this research and for your insights on the topic. Thank you to my second supervisor, Ir. Leon Hombergen, for always pushing me to be critical and approaching the topic from all viewpoints, it helped me look at all perspectives in my report. Special thanks to my company supervisor, Ing. Dirk Somsen, for all the exposure you provided and your unwavering support. Your outlook and knowledge on the topic and the industry helped me comprehend the topic further and understand complex concepts within the industry in a short period of time.

I would also like to express my gratitude to Fluor Consultants B.V. for providing me the opportunity to conduct my research. I would like to also thank everyone from Fluor, who gave me their valuable feedback on my topic and suggestions on improvement throughout my internship. Additionally, I would like to thank each one of the participants in the semi-structured interviews who provided significant input into this research.

Finally, my heartfelt gratitude to my family and friends (back home and in the Netherlands) for always being by my side and supporting me in every step of this journey. A special thanks goes to my husband, Irfan, thankyou for always being there and helping calm me down each time things got a bit overwhelming. Thank you for making things easier. This journey would not have been possible without you and your food. Special mention to Barshaleena as well, for always reminding me that we are in this together. Definitely, this achievement would not have been possible without you all!

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EXECUTIVE SUMMARY

Over the past few decades, the topic of sustainability has seen an increasing emphasis among various companies (Smith, 2014). Sustainable procurement has also been seen increasingly in the goals of purchasing and supply chain managers seeking to demonstrate sustainability in their procurement (Walker et al., 2012). However, within EPC companies, the integration of sustainability into procurement is still a small movement (Pianoo, 2019). There are quite some ambitions among EPCs at the strategic level regarding the topic, such as being net zero or carbon neutral, but implementation at project level is still lacking. This can be because of lack of knowledge, different client priorities, difficulty assessing the sustainability level of supply chain actors (suppliers/(sub-)contractors) and the lack of governmental legislations pushing the topic (as seen in the infrastructure industry). But this gap between ambition and implementation needs to be bridged in order to carry out sustainable project implementation. A possible step to bridge this gap is by integrating sustainability into project procurement. This will help EPC companies achieve their strategic goals and integrate sustainability at the project level. It has also now become necessary for companies in the oil, gas and petrochemical sector to look at more sustainable ways of executing their procurement practices, in order to manage their impact on the environment and society. Thus, the problem that this study addresses is :

"The ambitions within EPC companies in the Energy & Chemicals(E&C)/Process industry, to integrate sustainability into their procurement practices at the strategic level, does not match its implementation at the project level. In addition, these companies do not approach the potential of sustainable procurement as seen in both the E&C/Process industry and infrastructure sectors"

To address this problem statement, the goal of this research is to develop a strategy for EPC companies to ensure effective and efficient integration of sustainability into their procurement practices. This is achieved through attaining three main objectives: First, conducting a comprehensive study on the topic and potential of sustainable procurement in the context of an EPC company. Second, developing a sustainability framework for integration into an EPC companies project procurement practices to assess the sustainability criteria and performance indicators of their supply chain actors. Third, to provide recommendations to the EPC company on how sustainability can be integrated into their day-to-day project procurement practices. To achieve these objectives, the following main research question was proposed:

How can sustainability be integrated into the procurement practices implemented across all project phases of an EPC company?

The scope and context of this research study is focused on project procurement practices of EPC companies in the Netherlands within the Energy & Chemicals (E&C)/Process industry, executing oil, gas and petrochemical projects.

Research Methodology

The research adopts a qualitative approach to answering the main research question formulated. The research study was divided into three phases to ensure maximum insight was gathered. In the first phase,

a thorough literature and document review was conducted. The goal of the literature and document review was twofold: First, create an understanding about the characteristics of EPC companies in the E&C/Process industry. This was to ensure that the context in which this research was structured was understandable and comparable to the case company structure. Second, to develop a holistic conceptual sustainability framework from reviewing literature and case company documents. The sustainability framework consisted of a set of sustainability criteria and performance indicators which can be used to assess the sustainability level of an EPC company's suppliers/(sub-)contractors. In the second phase, semi structured interviews were conducted to understand views from practice regarding the topic of sustainable procurement. Main insights gathered included understanding the enablers and barriers encountered by EPC companies during implementation of sustainability into procurement, the prioritization of the identified performance indicators, incentives to stimulate sustainable procurement and suggestions for improvement. The third and final phase synthesized all the findings gathered so far, to propose a strategy or solution for EPC companies to integrate sustainability into their project procurement practices.

Building the conceptual sustainability framework

The main objective of this research study was to develop a sustainability framework that could be integrated into an EPC company's project procurement practices. It consisted of sustainability criteria and performance indicators that can be used to assess the sustainability level of supply chain actors. The sustainability framework developed based on the Triple Bottom Line (TBL) concept consisted of 12 environmental criteria and 33 corresponding performance indicators, 9 social criteria and 22 corresponding performance indicators and 11 economic criteria and 28 corresponding performance indicators. Due to existence of several economic criteria and indicators already in current procurement practices of the EPC case company, the focus of the final prioritized framework was on the environmental and social aspects of sustainability. The insight gathered from literature and document review and the prioritization provided by interviewees during semi structured interviews resulted in the final sustainability framework with 12 environmental criteria and 34 performance indicators and 9 social criteria and 22 performance indicators. The sustainability criteria and corresponding performance indicators identified in the final prioritized framework and validated by experts during expert evaluation, for implementation into practice, is depicted below:

Table 1: Final sustainability framework (after prioritization and expert evaluation) to be applied in practice

TBL aspect	Criteria	Performance indicators
	Environmentally conscious purchasing (E1)	Maximize resource efficiency (E1.1)
		Green purchasing/Green procurement (E1.2)
		Responsible and local sourcing (E1.3)
	Green Supply Chain Management (E2)	Suppliers (Tier 1, Tier 2) environmental responsibility and performance (Inbound logistics and procurement, Materials Management, Outbound logistics, Packaging, Reverse logistics) (E2.1)
	Environmental performance (E3)	Material efficiency-Opportunity for material Reduce, Reuse, Recycle, Remanufacture and Disposal and Disassembly (E3.1)
		Opportunity to use second-hand equipment (E3.2)
		Local environmental impact (E3.3)

TBL aspect	Criteria	Performance indicators
ENVIRONMENTAL		Environmental considerations made (Environmental efficiency of operating procedures, use of sustainable materials, Biodegradable/compostable (%), Emissions and waste (per unit of product), Pre/post-consumer recyclable content (%), Recyclable item (% of total), Volume of waste sent to landfill, renewable fuels used, use of ozone depleting substances) (E3.4)
		Environmental certification (LEED/Ecovadis/CSR) (E3.5)
		Spill prevention plans (plans+methods of containment for different spills/spill response to different substances) (E3.6)
		Environmental stewardship (processes and technologies focusing on increased environmental stewardship) (E3.7)
		Use of conflict minerals (tin, tungsten, tantalum, gold) (E3.8)
	Pollution Control and Waste Management (E4)	Waste reduction strategies: (1) Can waste be recycled rather than sent to a landfill? 2) Can disposal in landfills or incinerators be minimized? 3) Can unused materials be returned to suppliers? 4) Can equipment packaging be returned to suppliers? 5) Can environmentally preferred products (ones that are easier on the environment) be used?) (E4.1)
		Site waste management plan (Including Waste minimization plans such as (E4.2): (1) Eliminating equipment pieces or connections where possible 2)Modifying or replacing standard equipment pieces, for example, using seal-less pumps 3)Using design practices that provide early detection of losses (e.g., aboveground tanks and piping) 4) capture and recycle to prevent or minimize waste generation 5) carry out 'process stream inventory" to consider streams with potential to generate waste)
		Pollution Control (pollution factors constituted from the supplier production and service processes and product components. Related with air emissions, wastewater, spills noise, soil, odor, and solid wastes) (E4.3)
	Management of hazardous substances (E5)	Hazardous substances management (requirements facilitating safe handling, use, storage, and disposal of hazardous chemicals/materials/substances) (E5.1)
		Design of products to avoid or reduce use of hazardous products and their manufacturing process (E5.2)
		Regulations on use of hazardous substances (E5.3)
		Hazardous air emissions (CFC's, EtO, MEK, Toluene, etc.) (E5.4)
	Life cycle Assessment (E6)	Life Cycle Analysis (E6.1)
		Life Cycle Costs, Net Life Cycle Costs (E6.2)
	Environmental regulations/ Environmental compliance (E7)	Environment related certificates (ISO 14000/ISO 14001/ EMAS/ AS NZS ISO 14001) (E7.1)
		Environmental compliance with environmental laws and regulations (also local regulations such as having CO2 scrubbers or denox installations for exhaust emissions) (E7.2)

TBL aspect	Criteria	Performance indicators
ENVIRONMENTAL	**Environmental Management Systems (EMS) (E8)**	EMS Program Development, Implementation, and Evaluation (E8.1) - Pollution Prevention and Waste Minimization Programs - Sustainability Programs - Energy Efficiency Programs - Air, Water, and Soil Monitoring - Permit and Consent Coordination - Air Dispersion Modeling - Environmental Impact Assessment - Spill Prevention/Control Countermeasure Planning - Environmental Audit/Assessments - Waste Disposal Planning
		Existing environmental management systems (E8.2)
	Energy efficiency (E9)	Reduction in energy consumption (both direct (natural gas, diesel, gasoline) and indirect energy use (for electricity)) (E9.1)
		Use of renewable energy (E9.2)
		Amount of energy and efficiency required for the products manufacture and assembly (amount of energy used per unit of product) (E9.3)
	GHG emissions/Carbon footprint/ Carbon management (E10)	Carbon reduction in project execution, operations, and maintenance (E10.1)
		Reduction and evaluation of CO2 emissions and CO2 footprint (e.g.: Co2 prestatieladder) (E10.2)
		Carbon reduction targets in project execution, operations, and maintenance (E10.3)
	Product stewardship (E11)	Design for the environment (E11.1)
	Green competencies (E12)	The type of materials making up the supplied component (E12.1)
		Availability of clean technologies (E12.2)

TBL aspect	Criteria	Performance indicators
SOCIAL	**Employment practices (S1)**	Diversity, Equity, and Inclusion (S1.1)
		Corporate code of conduct (S1.2)
		Employee benefits (such as dialogue with employees, training and education, employment stability, career development, working hours, wages and benefits, security and welfare, privacy, PayOK certificaat) (S1.3)
	Health and safety (S2)	Health and safety of employees and community (S2.1)
		Accident prevention and exposure to harmful materials or process or health risks (S2.2)
		Safety total case incident rate (TCIR) (S2.3)
		Operational facilities are ISO 45001/ OHSAS 18001 certified (S2.4)
		VCA (Veiligheid, Gezondheid en Milieu Checklist Aannemers)/ VCA P veiligheidscertifcaat (S2.5)
	Local Community Influence (S3)	Skills enhancement of local workforce (S3.1)
		Community dialogue and engagement (S3.2)
		Investment in local community and community involvement (S3.3)
		Diverse and local suppliers (S3.4)

TBL aspect	Criteria	Performance indicators
SOCIAL	**Stakeholder's influence (S4)**	Stakeholder relations and participation (S4.1)
		Information provision (S4.2)
	Company efforts (S5)	Social responsibility efforts (S5.1)
		Training and programs for employees for green consciousness (S5.2)
		Environmental image of company (S5.3)
	Discrimination (S6)	Discrimination in employment (age, religion, gender, and other similar factors) (S6.1)
		Racial or sexual discrimination and harassment (S6.2)
	Child/Forced labor and rights (S7)	Measures to prevent or eradicate child or forced labor (S7.1)
	Employee and stakeholder rights (S8)	External stakeholder human rights (e.g., local communities, civil society) (S8.1)
		Rights of indigenous people (S8.2)
	Contribution to society (S9)	Tools and resources to support community building, charity, volunteering (S9.1)

Approach for implementation into practice

Once the sustainability framework has been developed, a strategy regarding its integration into practice is created. The solution is approached in three steps: First, the barrier hindering the integration of sustainability into project procurement are identified, prioritized and mitigation steps proposed. A total of 19 barriers were identified with high price/cost and role of client/owner being identified as barriers with highest likelihood and severity. Second, once the barriers were addressed, the sustainability framework could be integrated into practice. Since the focus of the research study was on all/any project phase, suggestions on how it could be integrated were provided. For example, proactively mentioning sustainability actions and ambitions to clients in winning the work phase, integrating the sustainability framework into prequalification and selection, evaluating the performance based on the framework in project close-out, and so on. Since the prequalification phase was identified as having maximum impact when the sustainability framework is integrated into it, two strategies were proposed regarding its integration. Finally, potential suggestions were proposed to incentivize or trigger further sustainability actions from SC actors. Main suggestions include giving a bonus for sustainability actions in projects, providing freedom to maneuver, providing a scoring for sustainability in technical/commercial bid evaluations and looking at multidisciplinary efforts to stimulate sustainability from SC actors.

Recommendations and implications for future research and practice

For *further research*, it is recommended to develop quantitative measurement indicators for the sustainability criteria and performance indicators identified in the sustainability framework. This will ensure performance can be measured quantitatively and scores or weightages provided accordingly. Furthermore, understanding the applicability of this framework in other industries (such as construction, infrastructure, etc.) and among other actors in the project chain, such as clients, suppliers or (sub-)contractors, is also beneficial. The effect of multi-disciplinary team collaborations in promoting further development in the topic of sustainable procurement can also be explored.

For *EPC contractors/company*, several recommendations were provided. They included introducing sustainability into technical/commercial bid evaluations, collaborating with clients to integrate sustainability into procurement and setting clear ambitions and targets. Few other recommendations included being pro-active, including a sustainability topic/sustainability pitch in discussions with clients, having multi-disciplinary discussions, looking at early involvement of supply chain actors, exploring possibilities within the industry, triggering ambitions among SC actors, and exploring possibilities in steel, which is considered one of the major pollutants in the process industry.

For *clients* in the *E&C/Process* industry, recommendations provided involve including sustainability in RFP's (Request for Proposals to (sub-)contractors) and RFQ's (Request for quotations to suppliers), providing EPCs and SC actors freedom to maneuver, having regular progress meetings and discussion and setting aside a budget for sustainability.

For *clients* in the *infrastructure* industry, it was proposed that it would be beneficial to focus beyond MKI calculations, as well as collaborate further with other actors in the project chain and be open towards more unsolicited proposals.

For SC (supply chain) actors, recommendations included being pro-active about the topic of sustainability, describing ambitions clearly and being clear and transparent regarding possibilities for sustainability in the project.

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GLOSSARY OF ABBREVIATIONS & TERMS

FCBV	Fluor Consultants B.V.
EPC	Engineering, Procurement & Construction
EPCM	Engineering, Procurement & Construction Management
EPCs	EPC companies
SC	Supply Chain
SC actors	Supply chain actors, i.e., suppliers or (sub-) contractors
(sub-)contractors	Downstream actors who are referred as contractors/subcontractors based on individual client terminologies. They are contracted by an EPC company/Client for their services/labour
Suppliers	Downstream actors from whom EPC companies procure materials/equipment
Upstream/Prime contract	Upstream contract between Client and EPC company
Downstream/(sub-)contract	Downstream contract between EPC company and their (sub-)contractors
E&C	Energy & Chemicals (similar to process industry, executing oil, gas, and petrochemical projects)

CHAPTER 1

INTRODUCTION

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CHAPTER 1: INTRODUCTION

To introduce the reader to this research study, chapter 1 presents the research background (1.1), followed by an introduction to the case company (1.2), a brief outline on the concept of sustainable procurement which is the theme of this study (1.3) and the gap between ambition and implementation (1.4) leading to the problem statement (1.5). This is followed by the research gap (1.6), the research objectives (1.7) and the research questions to address the objectives (1.8). Then, the research design is explained (1.9), followed by the research relevance (1.10) and the chapter concludes with the thesis outline (1.11)

1.1 Background

Sustainability is seen as one of the most important challenges faced by the world today (Silvius, 2017). In order to address this challenge, sustainable development is being considered the leading model of development for organizations and nations as a response to the various environmental issues and the social inequalities present in the world (Waas et al., 2014). This in addition to the different global, national and regional government ambitions, makes sustainability and sustainable development a topic that requires much attention. Within the Netherlands, agreements such as the Climate Act which calls for a 49% reduction in greenhouse gas emissions by 2030 compared to the 1990 levels and a 95% reduction by 2050 (Klimaatakkoord, n.d), the Environmental Management Act which provides stipulations regarding waste management, emissions and discharge of harmful substances, etc. (Government of the Netherlands, n.d.) are few of the steps taken at the national level to achieve sustainable development. In addition, the commitment of the Netherlands to 14% sustainable energy by 2020, 16% sustainable energy by 2030 and almost 100% sustainable energy by 2050 (Government of the Netherlands, n.d.), makes it crucial for organizations to embrace this transition and consider integrating sustainability into their everyday practices. But this transition can only be sustainable if it is not at the expense of anyone (Pianoo, n.d.).

Organizations often attempt to achieve sustainable development through integrating sustainability aspects into their projects or into their corporate ambitions. Corporate sustainability refers to “a systematic business approach and strategy that takes into consideration the long-term social and environmental impact of all economically motivated behaviors of a firm in the interest of consumers, employees, and owners or shareholders” (Bergman et al., 2017). But considering strategies involving the organizations alone are not enough. Corporations/organizations also need to depend on their supply chain to achieve their sustainability ambitions. The global supply chains can be seen as a vast, dynamic and interdependent network, creating a complex environment that has the potential to do harm to people, the planet and the economy. A supply chain is defined as “the set of entities that are involved in the design of new products and services, procuring raw materials, transforming them into semifinished and finished products and delivering them to the end customers” (Swaminathan & Lu, 2015). A sustainable supply chain is one that also considers the goal of upholding environmental and societal values, in additional to their conventional goals of speed, cost and reliability of operations (Luther, 2021). Such a sustainable supply chain supports a company’s efforts to consider the environmental and social impact of their journey within supply chain, from sourcing to delivery and every link in between.

Therefore, an important strategy for an organization hoping to achieve their sustainable ambitions is to not focus on achieving sustainability at a corporate or organizational level alone, but also attempt to have a sustainable supply chain. Cherel-Bonnemaison et al., 2021 mentions that two-thirds of the average company's environment, social and governance footprint lies with supply chain. This is because, by nature, supply chains often involve energy-intensive activities such as production, transport over long distances, etc. which leads to emissions and other environmental and societal impacts. One way in which organizations can embed sustainability into their practices involving the supply chain, is thus through their 'procurement' process. Procurement is simply the process of acquiring goods and services for an organization. Procurement also includes all functions that pertain to the obtaining of any material, service or construction such as description of requirements, selection and solicitation of sources, preparation and award of contract and all phases of contract administration (Lloyd & McCue, 2004). By embedding sustainability into their procurement process such as their supplier/(sub-)contractor selections or evaluation or shortlisting, etc., it is possible for organizations to make a decisive difference and achieve their sustainable ambitions in an environmentally and socially responsible manner, which is also economically feasible.

1.2 Case company introduction: Fluor Consultants B.V. (FCBV)

This research is facilitated and supported by Fluor Consultants B.V. (abbreviated as FCBV), which is part of the bigger Fluor Corporation. Fluor Corporation is an American publicly traded professional and technical services company headquartered in Irving, Texas, delivering engineering, procurement, and construction projects around the world for more than 100 years. Fluor's clients include leaders in energy, chemicals, life sciences, advanced technologies, mining, metals, and infrastructure, as well as government agencies. The choice of Fluor as the case company for this study is due to their acknowledgements for industry leadership and project excellence. Fluor was also ranked No. 259 on the Fortune 500 list of largest American companies in 2022, as well as ranked No.5 in ENR's 2022 list of Top 400 contractors and No.2 in ENR's 2022 list of Top 20 contractors in the petroleum and industrial sector (Fluor, n.d.). These industry standards in addition to their projects executed such as the Gordie Howe International Bridge Project, MEGlobal Monoethylene Glycol Manufacturing Project, and their projects focusing on energy transition and circular economy in the Netherlands, makes this case company well suited for this research study.
Fluor Consultants B.V. (FCBV/Fluor Netherlands) has been operating in the Netherlands for more than 55 years, providing professional and technical solutions to deliver safe, well-executed, capital-efficient engineering, procurement, and construction (EPC) projects throughout Europe and around the world. Thus, throughout this research, the case company, Fluor Consultants B.V (FCBV) will be referred to as an EPC service provider or an EPC contractor or an EPC company. The main reason for this classification is that FCBV provides their clients with three major services:

- Engineering (which includes providing services such as feasibility study, pre-design, design and engineering)
- Procurement (which includes material management and contract management services, further elaborated in Figure 1.1)
- Construction (which includes providing fabrication/construction, commissioning and start-up services)

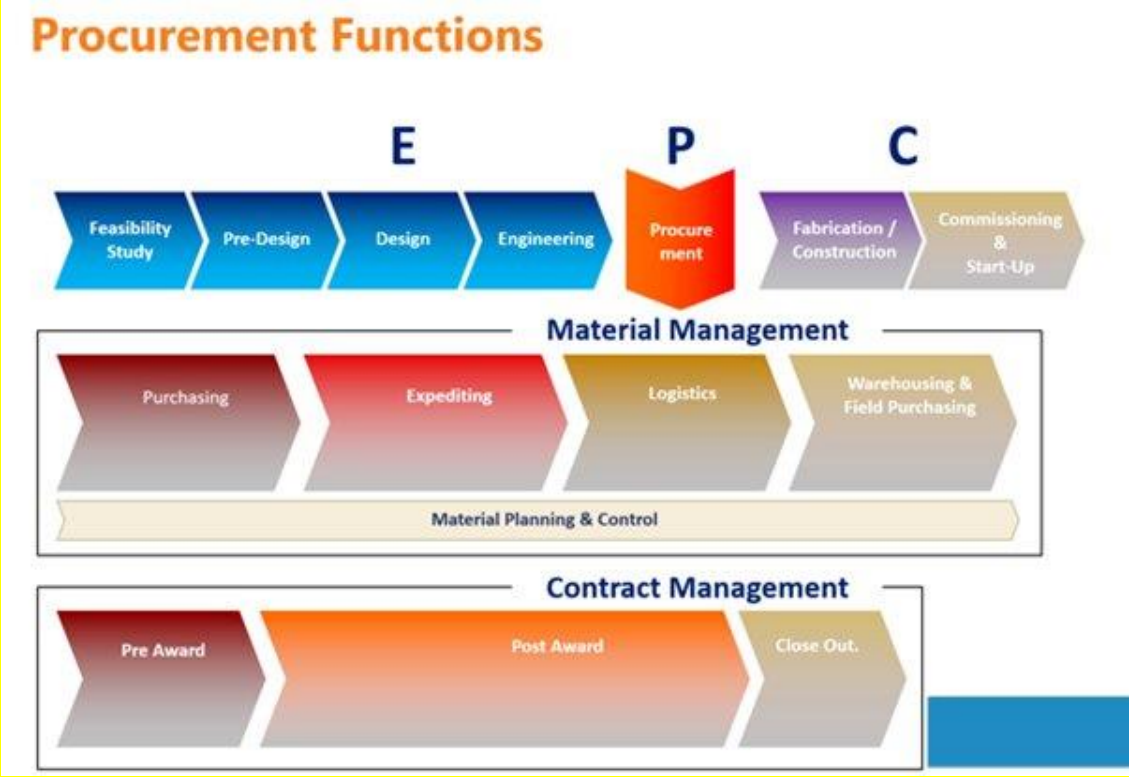

Figure 1.1: Procurement functions at FCBV (retrieved from company internal training)

Within the Netherlands, it is important to note that FCBV acts in an EPCM role, where they provide Engineering, Procurement and Construction Management (EPCM) services to the client or owner. The differences between EPC and EPCM roles will be explained in detail in section 2.1.

Thus, as a company that not only provides engineering and construction services, but also procurement services (which is also the scope of this research), the term EPC contractor covers the range of services provided and is hence a better terminology. Thus, referring to Fluor Consultants B.V as an EPC contractor/EPC company shows the importance 'procurement' has in accomplishing the company's sustainability goals.

1.3 Sustainable Procurement

It was only recently that the procurement function has focused attention on sustainability criteria along with the traditional criteria of cost, lead time, flexibility and exposure to risk (Walker &Brammer, 2009; Ghadimi et al., 2016). With the current trends in the market progressing towards outsourcing and sustainability, procuring materials and services in a sustainable manner through strategic supplier/contractor selection plays a significant role in an organization meeting its objectives.

In simple terms, sustainable procurement refers to "the acquisition of goods and services in a way that ensures that there is the least impact on society and the environment throughout the full life cycle of the product" (Meehan & Bryde, 2011). The International Organization for Standardization, 2017 also defines sustainable procurement in a similar manner as "Sustainable procurement is the process of making

purchasing decisions that meet an organization's needs for goods and services in a way that benefits not only the organization but society as a whole, while minimizing its impact on the environment".

There are many reasons why incorporating sustainability into procurement practices can be beneficial. Some of the benefits mentioned by Dowden, 2014 are:

- Reduction in exposure to risk: Reduced financial impact on brand value from bad supplier practices (e.g., child labour, local pollution), economic cost of supply chain disruptions (e.g., due to noncompliance with environmental regulations)
- Competitive advantage
- Cost savings: Reduction in total cost of ownership (TCO) due to reduced energy costs, reduced consumption and reduced social and environmental compliance costs.
- Revenue growth: Additional revenue through use of ecofriendly products/services, income from recycling programs, etc.
- Improved relationship with supply chain: Developing better and strategic relationships with supply chain.
- Meeting corporate social responsibility objectives
- Increasing sales with 'ethical customers'
- Increased opportunities to embed sustainability within sourcing and supply chain management activities.

1.4 Gap between ambition and implementation

Considering the various benefits of sustainable procurement for the organization as well as to society and the environment, it should be a common practice implemented within the industry. However, in practice, there is often a clear gap between ambitions organizations have at the strategic level and its implementations at the project level (Wolfgang, 2017). This gap is applicable for ambitions regarding sustainable procurement as well. Often, the main drivers for integrating sustainability into projects is either client's willingness to pay for sustainability (Peentra & Silvius, 2018) or the focus given to the topic by the assigned manager at project level (Epstein, 2018). This means that, as long as sustainability is not a pre-requisite due to government rules/regulations or client requirements, integrating sustainability into projects or carrying out sustainable procurement practices in projects, depends on ambitions by different actors, making its implementation fragmented. Considering this, the problem statement of the study is formulated in section 1.5.

1.5 Problem Statement

Most studies acknowledge that within organizations, implementation is considered a significant challenge with only 30% of formulated strategies actually being implemented within the project organization (Chege et al., 2015). This gap between strategy and implementation regarding sustainable procurement is also observed during discussions involving the case company.

This means that, within an EPC company, there is a gap between the ambitions at the strategic level (i.e., looking at future prospects, strategic discussions and long-term objectives, more top-level management)

and the implementation at the operational or tactical level (i.e., in the execution or project level) regarding sustainable project procurement. So, even if the company has the ambition to integrate sustainability into its procurement process, it faces difficulties in implementing it across their projects. This can be due to various reasons such as lack of commitment from client, lack of measurement tools or frameworks to ensure sustainable ambitions are achieved, lack of focus within the organization, lack of ambition within strategy makers to implement the strategies and an overall application of sustainability based on a cost-benefit viewpoint (Ershadi et al., 2021). This is different from the public or infrastructure sector where public bodies are being encouraged to procure sustainably in order to reduce their social and environmental footprint (Brammer & Walker, 2011).

The problem statement addressed by this study is therefore formulated as:

"The ambitions within EPC companies in the Energy & Chemicals(E&C)/Process industry, to integrate sustainability into their procurement practices at the strategic level, does not match its implementation at the project level. In addition, these companies do not approach the potential of sustainable procurement as seen in both the E&C/Process industry and infrastructure sectors."

Thus, this study aims to address this problem statement and bridge this gap, in order to help EPC contractors/companies, carry out sustainable project procurement that is socially and environmentally responsible, as well as economically feasible.

1.6 Research gap

Over the past three decades, sustainable procurement has slowly become an accepted part of doing business for large multinational companies (Ecovadis, 2021). But focus on this topic is still lacking when it comes to mid-sized organizations, especially in the private sector. This is because "while the public sector is supported by the government to incorporate sustainability in its processes, the private sector relies on its budget and applies sustainability based on a cost-benefit viewpoint" (Ershadi et al., 2021). This means that fewer research is available on how private EPC companies can carry out sustainable procurement in projects. This is also supported by the fact that, private organizations being more 're-active to their clients', makes it difficult to integrate sustainability into their procurement process unless specifically demanded by clients or economically beneficial. The topic of sustainable procurement is also less explored in the domain of EPC projects in the oil, gas and petrochemical industry (also called Process/Energy & Chemicals industry). This is because conventional clients are more focused on traditional constraints like delivering the project on time and budget rather than on aspects such as sustainability. Literature focusing on sustainability within supply chain in the E&C/Process industry is thus quite limited (Okeke, 2021; Ahmad et al., 2017; Midttun et al., 2007). Additionally, often the focus is more on the environmental aspects of sustainability, and less on the social aspects (Seuring & Muller, 2008; Morali & Searcy, 2013; Rentizelas et al., 2020). Thus, this research addresses the need to understand how EPC companies in the E&C/Process industry can operate more sustainably throughout their supply chain by integrating sustainability into their project procurement practices. This will ultimately help influence the transition towards a sustainable economy and create a more resilient and sustainable organization.

1.7 Research Objectives

To approach the research problem and address the research gap, a research objective needs to be formulated. In this research study, the following three key objectives are set:

First: Create a comprehensible study on the topic of sustainability within project procurement in the context of an EPC company

Second: Develop a 'sustainability framework' for potential integration into project procurement practices of an EPC company

Third: Provide recommendations to EPC company on how sustainability can be integrated into their project procurement practices.

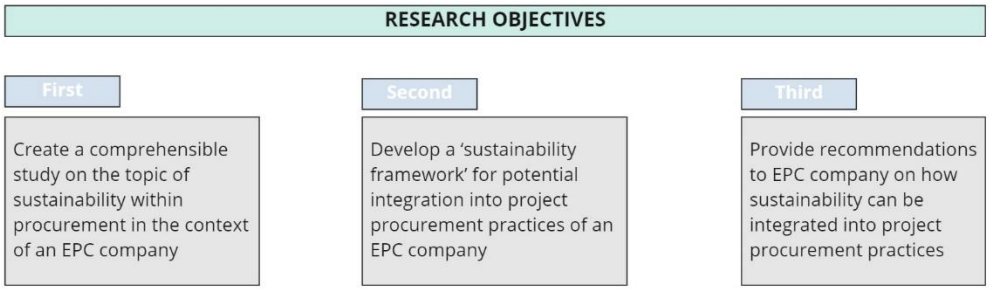

Figure 1.2: Research objectives

Thus, by achieving these three objectives, a strategy towards integrating sustainability into the procurement practices in projects of an EPC company is developed, ultimately helping create a resilient, competitive and green EPC contractor/company.

1.8 Research Questions

Once the research objective has been formulated, the next step is to define the research questions that can help achieve that objective. The main research question is:

MRQ How can sustainability be integrated into the procurement practices implemented across all project phases of an EPC company?

This research question aims to trigger a set of recommendations to the EPC company on what sustainability criteria and performance indicators can be potentially integrated into project procurement practices across all project phases (winning the work, baseline definition, executing to the baseline and project completion), of an EPC company. To answer this overarching research question, the following sub-questions are defined. They are:

SQ1 What are the characteristics of EPC companies within the Energy & Chemicals/Process industry?

This sub-question provides the reader with an introduction into the concept of an EPC (Engineering, Procurement and Construction) company. The topics introduced in this research question includes the

contract type commonly used in EPC projects, the procurement procedure, and the project phases. This provides an understanding of the context of an EPC company and supports the topics addressed in further sections.

SQ2 How can EPC companies assess the sustainability level of their suppliers/(sub-)contractors?

The goal of this sub question is to develop through literature review (academic sources) and document review (Fluor internal sources), a holistic list of potential sustainability criteria and performance indicators that could add value when integrated into project procurement practices. This conceptual 'sustainability framework' developed will be critical to forming a basis for answering the subsequent research questions.

SQ3 What enablers and barriers are encountered by EPC companies in integrating sustainability into their procurement practices?

By answering this sub question, the enablers and barriers faced by EPC companies in integrating sustainability into procurement is identified from the semi-structured interviews.

SQ4 How can the performance indicators be prioritized to add most impact when integrated into procurement?

By answering this sub question, the performance indicators identified in the 'sustainability framework' will be prioritized with the help of input from case studies and semi-structured interviews. Thus, the data collected from literature review and document review, case studies and semi-structured interviews is analyzed and synthesized to develop a concise 'sustainability framework', that will have the most impact when integrated to the procurement practices in projects.

SQ5 How can the sustainability framework developed be applied in practice?

The goal of this sub question is to see how the sustainability framework developed can be applied in practice. Recommendations on how an EPC company can potentially include sustainability criteria and performance indicators into their procurement practices will be explored in this sub question in addition to looking at the role played by client and supply chain actors in influencing this process. This will also help ultimately answer the main research question as to how EPC companies can integrate sustainability into their everyday procurement practices.

1.9 Research Design

This section describes the research design of this graduation thesis report. A research design specifies the steps taken for collecting and analyzing the information required for the study. First, the research scope and context are defined (1.9.1) followed by the research methodology used in this study (1.9.2).

1.9.1 Research Scope and Context

Defining a research scope helps in identifying the limits of the research and defining what is included and excluded in the research. In this research study, the scope and context is defined in view of several considerations:

1] This study explores the integration of sustainability into the **procurement** practices of an EPC company within the process industry. Since the case company FCBV does not directly produce materials/equipment, their procurement practices involve acquiring materials and services from their downstream supply chain. Within FCBV, this includes both acquiring of materials and equipment from suppliers (MM-Material Management), and the acquiring of services and labour from (sub-)contractors (CM-Contract Management). At FCBV, both MM and CM are carried out by the "Supply Chain" organization. The Supply Chain organization is part of the project execution business line and provides support to all the business lines including energy solutions, urban solution and mission solutions (Figure 1.3).

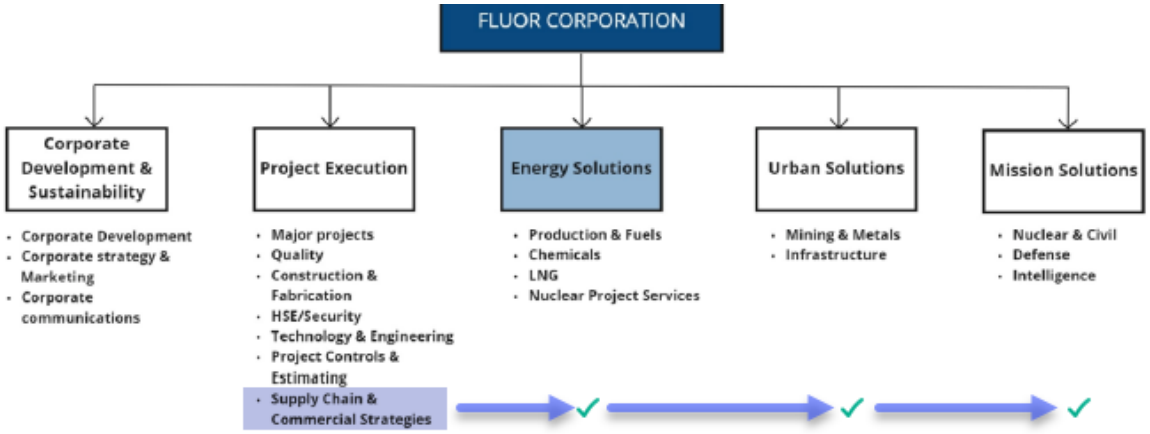

Figure 1.3: The organizational structure of the Supply Chain/Procurement department within FCBV (retrieved from Fluor internal documents, n.d.)

2] The focus is on projects with the "**Energy Solutions**" business line of FCBV (Figure 1.4). These include EPC (Engineering, Procurement and Construction) or EPCM (Engineering, Procurement and Construction Management) projects done in the **Energy & Chemicals (E&C) or Process industry** in the **Oil, Gas and Petrochemical sector**. These terminologies will be used interchangeably throughout this study. This business line is chosen as majority of projects conducted out of the FCBV office fall under this scope. Additionally, a brief look into the infrastructure sector is done, both from literature and practice, to see if there are any lessons from infrastructure that could be learnt and implemented into the Energy & Chemicals industry.

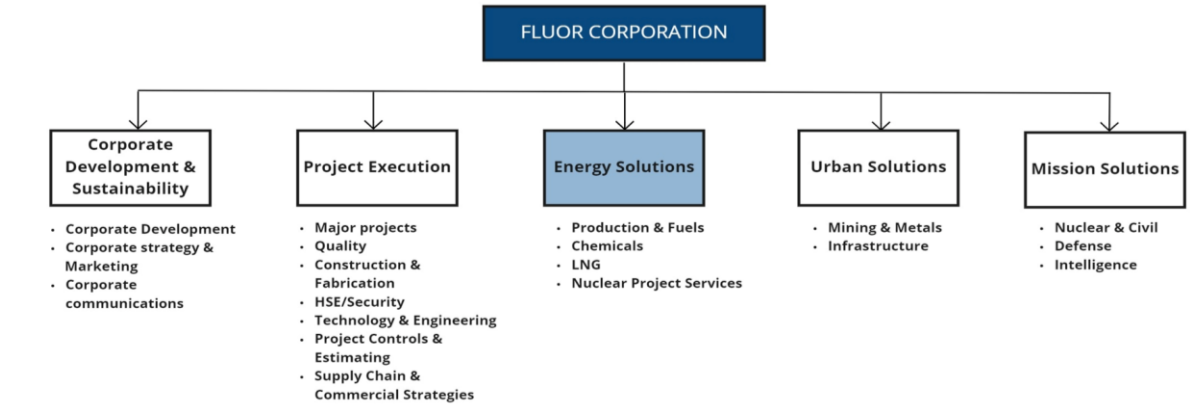

Figure 1.4: Fluor Corporation organizational chart {Retrieved from Fluor internal documents, n.d.]

3] The perspective of an **EPC service provider/EPC company/EPC contractor** is taken. This because of the central role it possesses in integrating sustainable procurement aspects both upstream to clients, as well as downstream to their supply chain (suppliers/(sub-)contractors). Also, the works done by FCBV fall under the EPC/EPCM category.

4] All project phases (winning the work, baseline definition, executing to the baseline and project completion) involved with the procurement practice of an EPC company are explored (Figure 1.5). This is because, the phases are connected, where sustainability aspects considered during defining the baseline, should be asked and evaluated during executing the baseline phase, which ultimately should be measured during project completion to see if performance of supply chain meets targets.

For this research study, Fluor Consultants B.V. (abbreviated as FCBV), an EPC service provider or company within the Energy & Chemicals/Process industry, executing oil, gas & petrochemical projects, will provide empirical evidence, while serving as a case study.

Figure 1.5: Project phases defined by Fluor [Retrieved from Fluor internal documents, n.d.]

1.9.2 Research methodology

The objective of this research is delineated in consequent steps.

Phase one- Literature & Document Review

The first research phase focuses on answering SQ1 and SQ2 through the use of literature and document review.

Literature review focusses on examining the body of research available in the form of journals and conferences, reports, papers, books and other such publications regarding the selected topics. Through literature review, part of SQ1 and SQ2 are answered. First, it will help in understanding the concept of an EPC company and its practices (SQ1). Second, it will help identify a holistic list of sustainability criteria and corresponding performance indicators, which will make up the conceptual sustainability framework that will potentially be integrated into the procurement practices of an EPC company (SQ2). Performance indicators are used to evaluate performance and enable the reduction of large amount of information to a small amount of key and detailed data, presenting the goal achievement (Midor et al., 2020). Section 2.2.4 shows the procedure undertaken for conducting the literature review to develop the conceptual framework.

The goal of **document review** is also similar. It is the method through which the researcher scans and collects insight and data from the different documents present within the company (Fluor internal). It helps add to the information gathered from literature review regarding practices within an EPC company

(SQ1), as well as add to the holistic list of sustainability criteria and performance indicators making up the conceptual framework (SQ2). The documents reviewed include available documents relating to sustainability developed by Fluor, which describes ambitions of the organization, future goals, current steps taken, value creation topics as well as any existing practices being followed. Section 3.2 shows the procedure undertaken for conducting the document review to develop the conceptual framework.

Phase two- Semi-Structured interviews

The main data gathering methodology used in this study is **semi-structured interviews.** Semi-structured interviews are used to obtain empirical data from the project team. In this study, the methodology chosen was semi-structured interviews as they are commonly used in qualitative and interpretive research (Balushi, 2018). It also provides the researcher the opportunity to go in-depth to further understand the topic through interactions with interviewees (Myers & Neyman, 2007; Legard et al., 2003).

Before the semi-structured interviews could be conducted, exploratory interviews are carried out with Fluor professionals to identify projects (case studies) that have integrated sustainability into project execution. A total of 10 Fluor professionals were interviewed to identify case studies relevant to the study. A total of 7 case studies were identified. Five of the identified case studies were in the Energy & Chemicals industry and two in the infrastructure industry. The case studies provide a list of potential interviewees (Client, Fluor & Supply Chain) who were involved in the execution of the projects.

Through semi-structured interviews, there is also the possibility to "explore new paths that emerge during the interview that may not have been considered initially" (Gray, 2004). The goal of semi-structured interviews was twofold. **First**, to collect data on how professionals view the topic of sustainable procurement, including their thoughts on barriers, enablers, current practices and trends, etc., thus answering SQ3 (discussed in detail in chapter 4). The interviewees selected belonged to three main categories: *Clients, EPC company and Supply Chain* (suppliers/(sub-)contractors). This provides a holistic view on the different opinions and insight gained from the interviews regarding the topic of sustainable procurement in practice. **Second**, to gather interviewee insight on the conceptual sustainability framework developed and obtain their input on the priority or weightage to be given to each performance indicator. Thus, by comparing all interviewee rankings, the performance indicators are prioritized to create a concise framework which could potentially be integrated into the project procurement practices of an EPC company, thereby answering SQ4.

Phase three- Developing the solution & Expert validation

Based on the findings from the previous phases, in this phase, the final sustainability framework taking into consideration all interviewee input, is created. Additionally, a descriptive procedure on how sustainability can be integrated into project procurement is presented. This is based on insight gained on various barriers and enablers, the client and supply chain role in stimulating sustainable procurement, and other valuable input received from the interviews. These form the basis for the recommendations to be provided to the EPC company, thereby answering SQ5 and ultimately the main research question (MRQ).

Once the recommendations have been formulated, a group of expert professionals will be approached to validate the recommendations. The chosen experts are part of the Procurement & Contracts/Supply Chain department at Fluor, with a focus on sustainability. The goal of the expert validation is to get feedback on the sustainability framework developed and the recommendations provided to the EPC company in order to get an understanding about its applicability in practice.

1.10 Research Relevance

The contribution of realizing this objective is twofold: First, from an academic perspective, this research adds to the **theoretical body of knowledge**. At present, there is little research on the topic of sustainability in the procurement practices of an EPC company within the Energy & Chemicals/Process industry. A lot of research is done on sustainable procurement in the public sector and construction industry, but few papers focusing on private EPC companies. Also, there is limited research into the supply chain perspective and capabilities (such as specific in-depth knowledge on the materials/services they supply), to help EPC companies integrate sustainability into their procurement practices. It is far fewer when we zoom into an EPC company within the Energy & Chemicals (Oil, Gas and Petrochemical) industry. Thus, this research adds to the existing body of knowledge and provide insight into the EPC company perspective on how sustainable procurement can be implemented.

Second, for **practice**, it is highly beneficial for an EPC company to understand the factors that can influence successful implementation of sustainable procurement strategies in projects. This will ultimately help increase their market value and express themselves as an EPC company capable of achieving sustainable ambition through procurement. Additionally, identifying sustainability criteria and performance indicators that can add most impact when integrated into project procurement will provide organizations recommendations on how they can enhance their current procurement practices, while taking into consideration market/industry ambitions and capabilities.

1.11 Thesis outline

The structure of the report is outlined in the subsequent steps. The first research phase, **Phase 1** provides an introduction into the context of the study and builds the conceptual sustainability framework based on insight gathered from literature review (chapter 2). It also includes the conceptual framework developed from document review and describes how the final conceptual framework is arrived at (chapter 3). The outcome of Phase 1 is the conceptual sustainability framework developed from extensive literature and document review.

The second research phase, **Phase 2**, focusses on the main data collection methodology used in the study, semi-structured interviews (chapter 4). All the empirical evidence gathered is discussed and studied in this chapter. The main outcomes of Phase 2 are an understanding on the various enablers and barriers to sustainable procurement, and how the sustainability indicators in the framework can be prioritized.

The research is concluded with **Phase 3**, which suggests an implementation approach for practice and validates the findings and recommendations against an expert panel discussion (chapter 5).

The final chapters, chapters 6 and 7, discusses the results obtained and concludes on the study, ultimately answering the main research question.

Figure 1.6 depicts the thesis outline.

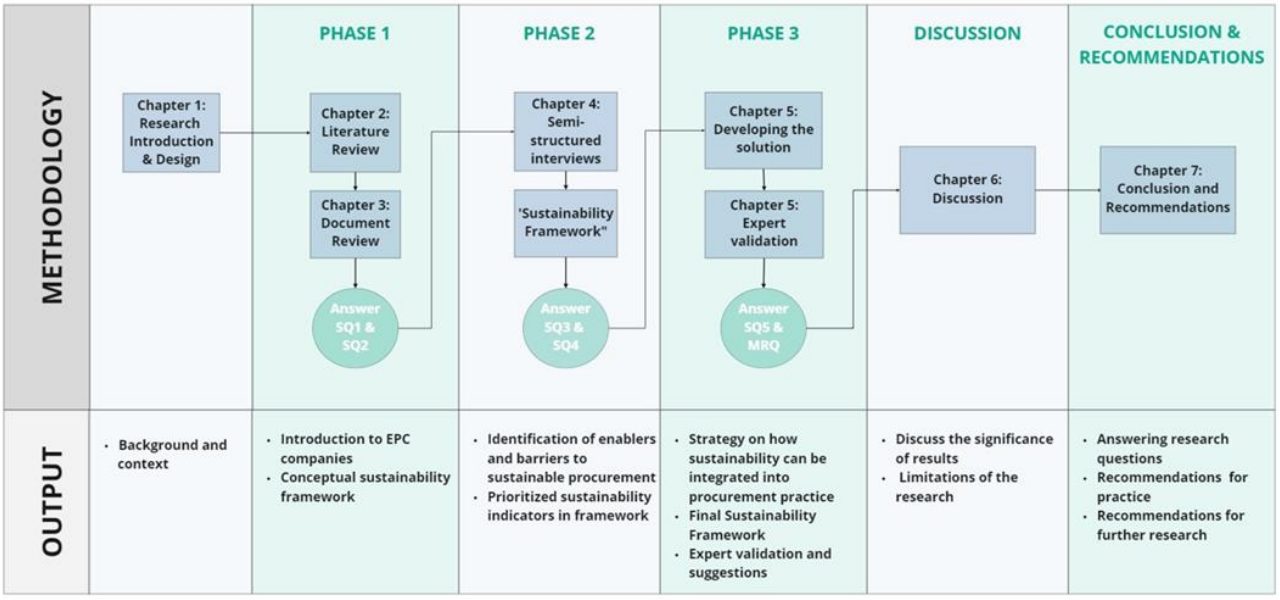

Figure 1.6: Thesis outline

PHASE ONE

LITERATURE & DOCUMENT REVIEW

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CHAPTER 2

LITERATURE REVIEW

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CHAPTER 2: LITERATURE REVIEW

This chapter presents the results of the literature (academic) review. The outcome of this chapter provides an understanding of the characteristics of an EPC company and partly the theoretical input for the conceptual framework developed, by answering:

SQ1 What are the characteristics of EPC companies within the Energy & Chemicals/Process industry?

SQ2 How can EPC companies assess the sustainability level of their suppliers/(sub-)contractors?

This chapter is structured as follows: to enable answering SQ1, first the attributes of an EPC company is explored (2.1). This includes understanding the differences between EPC & EPCM project delivery methods (2.1.1), the typical lifecycle of an Oil, Gas and Petrochemical (OG&C) project within the Energy & Chemicals industry (2.1.2), the contract types used in EPC/EPCM projects (2.1.3), and a description of the procurement process carried out by them (2.1.4). In order to partly answer SQ2: how the sustainability level of the supply chain actors of EPC companies can be identified, is explored (2.2). This includes exploring the different concepts of sustainability available in literature (2.2.1), understanding the role of sustainability in the industry (2.2.2), the benefits of a sustainable supply chain or procurement process (2.2.3). Finally, the sustainability criteria and performance indicators identified from literature are described to ultimately develop the conceptual sustainability framework from literature review (2.2.4). Finally, the chapter summary and next steps are described (2.3).

2.1 Attributes of EPC companies within the Energy & Chemicals/Process industry

2.1.1 EPC and EPCM

Oil, Gas & Petrochemical projects worldwide are managed through different contract types such as Engineering, Procurement & Construction (EPC), Engineering, Procurement and Construction Management (EPCM), Engineering, Procurement, Construction & Installation (EPCI), Engineering, Procurement Installation & Commissioning (EPIC) and Lump sum Turnkey (LSK) (Suppramaniam, 2018; Kombargi et al., 2012, Olaniran et al., 2015). The following section discusses two most common project delivery methods used in the Energy and Chemicals industry and relevant to this study: EPC & EPCM. Depending on client requirements and project conditions and risks, EPC or EPCM contracts/project delivery methods can be selected.

- *EPC (Engineering, Procurement & Construction)*

EPC delivery method is where the EPC contractor or service provider in the industry is responsible for all elements of the engineering services, procurement of materials and services and construction. The client/owner/operator provides detailed specifications and requirements to the EPC contractor, and it's their responsibility to carry out the engineering aspects of the project, the procurement of materials, equipment and service/labour, as well as the construction of the facility, plant or project (Suppramaniam, 2018). In an EPC project delivery method, it is also the EPC contractor who contracts the work with different suppliers/vendors (for materials) and contractors for construction works (civil, mechanical,

piping, specialized process, etc.) (Figure 2.1). EPC contracts are thus also called “turnkey contracts” as the contractor has the whole responsibility to build and deliver the project within a specified time to the client, usually on a fixed price or lumpsum contract basis (Hansen, 2015).

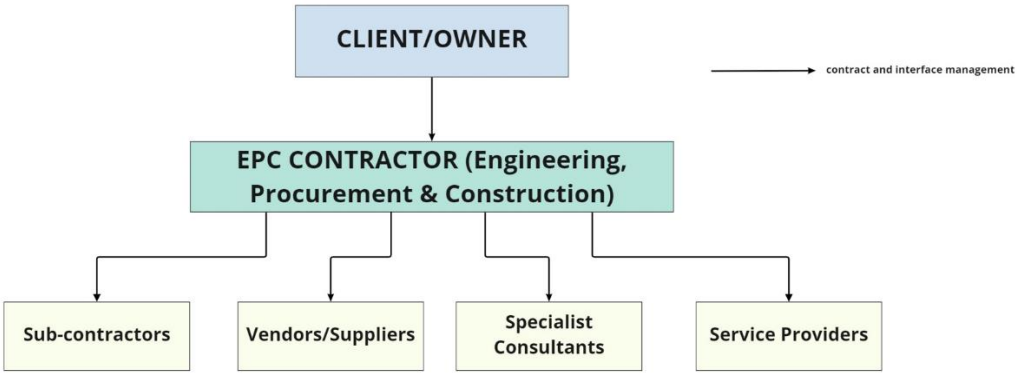

Figure 2.1: Typical EPC contractual structure (own illustration adapted from Schramm et al., 2010)

Advantages and disadvantages of EPC contracts

The main advantages of using EPC contracts from the owner’s point of view is that the EPC contractor is fully responsible for: cost of completion in case of lumpsum, time for completion and the quality of design, work and achievement of performance guarantees (Henchie & Loots, 2008).

One of the disadvantages of an EPC contract is the lack of client/owner involvement during the project execution and high cost of tender and risks (Hansen, 2015).

Risks

The main reason for the choice of the EPC type of contract is that the employer’s risk is distributed to the main EPC contractor. In EPC, the contractor holds all responsibility from the beginning (Hansen, 2015). This can potentially result in high contract prices which include contingencies and mark-up to counter against risks such as, performance, cost increase, time extension and potential loss (Schramm et al., 2010).

- *EPCM (Engineering, Procurement & Construction Management)*

EPCM delivery method is where the EPCM contractor or service providers is responsible for the engineering, procurement and construction management services. It is also known as a ‘professional services contract” (Henchie & Loots, 2008) and provides a more flexible approach in terms of schedule and budget in executing the project.

According to Henchie & Loot (2008), an EPCM contractor will assist the owner to manage the project and is responsible for:

- engineering and design (including basic engineering/FEED and developing detailed design)
- procurement of needed materials and equipment

- management and administration of the construction contracts.

The EPCM contractor acts for and on behalf of the client and draws up contracts between the owner/client and the contractors required for executing the project construction services. Or, in some other cases, the EPCM contractor can hire an outside construction contractor who they will manage on their own (H+M Industrial EPC, 2021). The EPCM contractor executes their work usually in a cost-reimbursable basis.

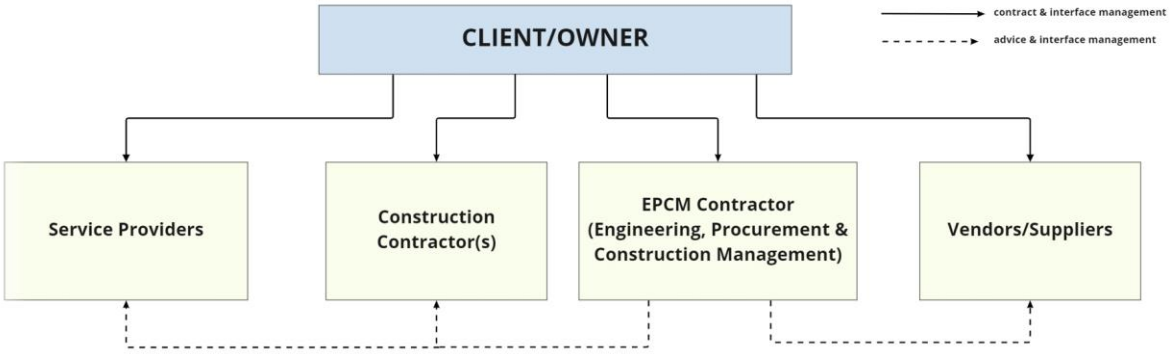

Figure 2.2: Typical EPCM contractual structure (own illustration adapted from Schramm et al., 2010)

Advantages and disadvantages of EPCM contracts

The main advantage is that, in EPCM delivery methods, the project owner/client retains more control of the project thereby reducing the risks placed on the EPCM contractor. The EPCM contractor is therefore also not liable for the schedule, cost or performance of the other contractors involved in the construction activities of the project (EPCM, n.d.). There is also more flexibility during project execution and procurement (Smith, 2012).

One of the disadvantages of an EPCM contract is that it requires a competent client's team and the EPCM contractor needs to be chosen very early in the project (Berends, 2014). No single point of responsibility is also a disadvantage for the client (Smith, 2012)

Risks

In an EPCM contract structure, the project is mostly managed by the owner and thus the cost risk is borne by the owner and less by the EPCM contractor, as is any cost overruns and savings (Schramm et al, 2010). So, the overall risk of meeting or not meeting project objectives of time, cost, quality and safety is mainly with the owner/client. Also, it is the obligation of the client to review and approve the processes for scope, engineering, procurement and contractual issues (Agnitsch et al., 2001).

2.1.2 Typical Energy & Chemicals (Oil, Gas & Petrochemical) project life cycle

Figure 2.3 shows a typical project life cycle of an Energy & Chemicals (E&C) project from scope definition to its completion.

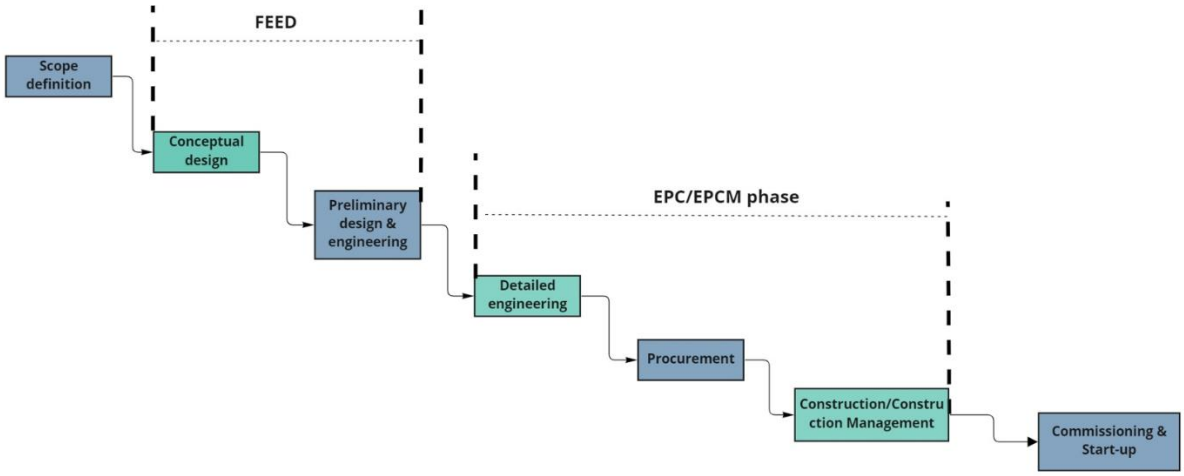

Figure 2.3: Basic EPC/EPCM project life cycle of E&C projects (own illustration, adapted from Crawley & Tyler (2015); Hansen (2015))

A basic E&C project can consist of the following steps as seen in Figure 2.3.

At the scope definition level, the client or the owner defines their requirements in a broad manner. At this stage EPC/EPCM contractors can also be involved in doing a feasibility study to ensure that the idea or requirements put forth by the client is legally, technically and economically justifiable.

In the conceptual development or conceptual design phase, the design variables and operating conditions are evaluated. "Conceptual design is a set of disciplined that contributes to identifying the optimal design at nominal operating conditions of industrial processes/products in the field of engineering" (Khan, n.d).

The conceptual design phase is followed by the pre-FEED phase which is a preliminary step before basic engineering, to develop project design basis and define boundaries. The outcome of the pre-FEED is used as the design basis for the next level of work-FEED or basic engineering (Chiyoda, n.d.). Within the Energy & Chemicals or Process industry, the conceptual and preliminary engineering phase can be referred to as the FEED stage (CII, 2004). In the FEED stage, engineering designs are created which are typically used as a basis for bidding and executing of the project. The FEED package can have EPC execution plans, specifications and standards to be followed, vendor assessments, process and instrumentation diagrams (P&IDs), hazard and operability study (HAZOP) and so on (Chiyoda, n.d.). The outcome from the FEED phase is called the basic design package or the FEED package. The pre-FEED and FEED stage is usually always contracted to an EPC/EPCM contractor, and sometimes the same company gets the EPC contract and carries out the EPC works as well.

After the FEED stage, the EPC/EPCM works begin, and detailed engineering takes place which includes gathering information needed regarding all project aspects before start of construction. Detailed engineering includes extracting all necessary information from basic engineering/FEED, calculations to provide the exact detailed drawings, bill of quantities and specifications for each equipment, and it may also involve 3D modelling (Khan, n.d.).

Detailed engineering is followed by procurement where raw materials and equipment from suppliers or vendors and services and labour from contractors are acquired at the best price and quality. The main procurement activities include sourcing, purchasing, expediting and materials management on site. These involve selecting the appropriate relationships and contracts for the purchased materials and equipment, preparing and evaluating quotations and proposals provided by bidding actors and awarding and signing of contracts and ultimately ensuring everything is available on site Until the procurement phase, the project lifecycle for an EPC and EPCM contract are similar. The difference occurs in the construction phase, where for an EPC contract, the EPC contractor themselves does the construction while in an EPCM contract, the EPCM contractor contracts other construction contractors to do the work and manages those contracts.

Once all the necessary material and services have been procured and provided for at the project site, offsite or onsite fabrication takes place where fabrication and assembly of parts or systems takes place at the plant or project location. This may include connecting the different pieces, equipment, pipes or other systems required (Khan, n.d.). The construction stage is thus where different elements and pieces are put together following a detailed design plan. The sequencing of construction will be planned to reflect the most logical and cost-efficient approach to meet startup and handover dates (Nethery, 1989).

After construction the pre-commissioning and commissioning phase is carried out, where it is verified that the facility or process has been designed, procured, fabricated, installed, tested, and prepared for operation or production as per the specifications of the client (Khan, n.d.).

This is then followed by the start-up phase where the plant is open for operation by the client/owner/operator.

Figure 2.4 shows the entire EPC process model in detail.

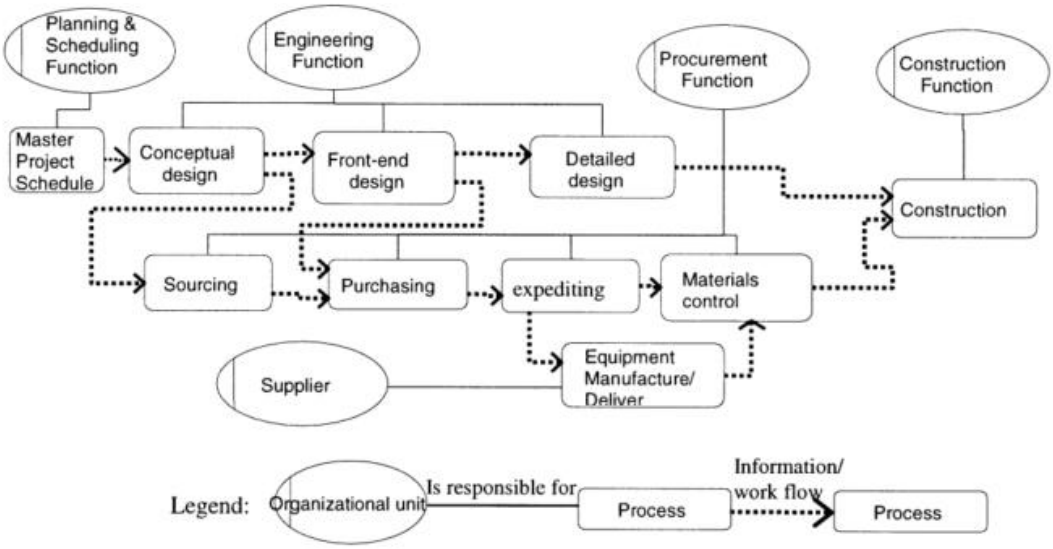

Figure 2.4: An EPC process model (Retrieved from Yeo & Ning, 2000)

2.1.3 Contract types used in EPC/EPCM projects

For the purpose of this study, the three main contract types discussed are '**cost reimbursable'**, '**unit price/unit rate**' and '**lump sum'** contracts. The goal of discussing these contracts is to provide an understanding of the main types of contracts used within EPC/EPCM companies in the Energy & Chemicals industry.

In **cost reimbursable contracts**, the EPC/(sub-)contractor will be reimbursed for all its costs plus an agreed upon fee (Moazzami, 2015). This is also called a Time & Material contract (Fluor internal documents, n.d.). This type of contract is used when the scope is not defined. The advantage of this type of contract is that there is also more flexibility in case of changes and unpredictable situations. The disadvantage is that a lot of supervision is required due to the lack of scope definition. In this type of contract, the EPC/(sub-)contractor also has some more freedom to suggest changes or ideas to the client/owner as project risks are mostly transferred to the client/owner (Moazzami, 2015).

Lumpsum and unit price are two major variations of fixed price contracts (Moazzami, 2015). In a **lumpsum contract**, the EPC/(sub-)contractor must carry out the project work on a stipulated price basis. Most of the risk and liabilities in case are also with the EPC/(sub-)contractor. Lumpsum contracts are preferred in cases where there is a well-defined scope with less chance for uncertainties and there is an early idea on total project cost and cost control. In a lumpsum contract there is also limited control on EPC/(sub-)contractor's execution.

In a **unit price/unit rate contract**, the (sub-)contractor performs each unit of work for a fixed rate (Moazzami, 2015). This type of contract is used for time driven projects. Here, the rates for performing each unit of work are fixed but the quantities are subject to change. Since no fixed quantities are required at contract award, this enables early contract award and beginning of works (Fluor internal training document, n.d.).

2.1.4 Procurement process of EPC companies in the Energy & Chemicals industry

Kaufmann (2002) describes procurement as "all processes of supplying the company with direct and indirect materials, services, rights, machinery and equipment from sources external to the organization, aimed at contributing to the achievement of sustainable competitive advantage". According to Monczka et al. (2015) and Johnson et al. (2011), the typical procurement process within the E&C industry involves:

1. Recognizing a need
2. Translating the need into a commercial description and developing needed documents
3. Searching for potential suppliers/contractors
4. Selecting a suitable source
5. Agreement on the order
6. Delivery of product or service
7. Payment

In an EPC contract within the E&C industry, with sometimes the exception of major equipment, the entire procurement process is carried out by the EPC contractor requiring little client involvement (Agnitsch et al., 2001).

In an EPCM contract within the E&C industry, procurement is managed by the EPCM contractor under the client's name. The EPCM contractors assists the owner in the purchasing of materials and long lead items as well as assigning the different major work packages to the different contractors. The EPCM contractor then puts in place the contracts and direct agreements on behalf of the owner (Henchie & Loots, 2007). The procurement process does take longer as the contracts and purchase orders (POs) need to be reviewed and approved by the client (Agnitsch et al., 2001).

2.2 Identifying sustainability criteria and performance indicators for assessing supply chain actors

EPC companies operating in the Energy & Chemicals industry need to understand and identify the sustainability criteria that add most impact in assessing the sustainability aspects of their supply chain (suppliers/(sub-)contractors.

This is achieved by first, understanding the concept of sustainability used in this study (2.2.1). second, need for sustainability in the Oil, Gas & Petrochemical industry (2.2.2) and the benefits of integrating sustainability into procurement/supply chain is briefly explored (2.2.3). Finally, the sustainability criteria and performance indicators are identified from academic literature which could have a positive impact when potentially integrated into the project procurement practices of an EPC company (2.2.4). The project procurement practices mentioned can include bidder selection, bidder evaluation and questionnaires, bidder performance measurement, and so on.

2.2.1 Exploring the different concepts of sustainability

Sustainability and sustainable development have become an important and common topic due to ongoing industrialization, climate change, resource scarcity and rising energy and material prices. But there is no singular definition for cover the concept of sustainability or sustainable development. Instead, a variety of views and definitions on what sustainability is, can be seen throughout academic literature (Isaksson et al., 2015; Birdsall, 2014).

The most commonly used definition of sustainable development mentioned in the UN World Commission report on Environment and Development, better known as the Brundtland Report (Kuhlman & Farrington, 2010) is that:

"Sustainable development is the development that meets the needs of the present without compromising the ability of future generations to meet their own needs."

Even though the term has been interpreted in different ways, the common notion is in line with the Brundtland report which considers the social (people), environment (planet) and economic (profit) dimensions of sustainable development, or the 3 P's (Silvius et al., 2012).

More recently, the Sustainable Development Goals (SDGs) were adopted by United Nations in 2015 and identifies 17 areas or goals as a universal call to action to end poverty, protect the planet, and ensure that by 2030 all people enjoy peace and prosperity (UNDP, n.d.). Figure 2.5 indicates these goals.

Figure 2.5: Sustainable Development Goals [Retrieved from https://www.undp.org/sustainable-development-goal. 2nd August 2022]

Being such a broad and vast topic, sustainability can be explained using different dimensions or concepts such as:

- **Triple Bottom Line (TBL)**

Triple bottom line (TBL) and sustainability are two related constructs often used interchangeably in literature (Alhaddi, 2015). The concept of TBL was first coined by Elkington in 1997 and expresses the environmental aspects in such a way that considers the economic and social lines (planet, people and profit) (Elkington, 1997). The TBL approach provides a framework for measuring the performance of the business and the success of the organization using three lines: environmental, social and economic (Goel, 2010). The TBL approach also places equal importance on each of the three lines: environmental, social and economic, thus bringing more balance into the level of importance that is given to each of these lines (Elkington, 1997; Epstein, 2008).

Economic Line

The economic line of the TBL framework refers to the impact that an organizations business practice can have on the economic system (Alhaddi, 2015; Elkington, 1997). The economic line thus looks at how the economic growth or economic value provided by an organization to its surrounding system supports and promotes the upcoming generations.

Social Line

The social line of the TBL framework refers to conducting beneficial and fair business practices to the labor, human capital and to the community (Alhaddi, 2015; Elkington, 1997). This line focusses on what

the organization gives back to its community. The social performance thus looks at interactions between the company and the society including aspects such as community involvement, employee relations and fair wages (Goel, 2010).

Environmental Line

The environmental line of the TBL framework looks at the need to take part in practices that do not compromise the environmental resources needed for future generations. This refers to reducing greenhouse gas emissions, using energy resources efficiently and minimizing the ecological footprint (Goel, 2010).

- **Corporate Social Responsibility (CSR)**

Corporate social responsibility (CSR) is a concept of sustainability usually used in the context of organizations. It is defined in the International Organization for Standardization (ISO) 26000 standards on CSR as:

"*The responsibility of an organization for the impacts of its decisions and activities on society and the environment, resulting in ethical behavior and transparency which contributes to sustainable development, including the health and well-being of society; takes into account the expectations of stakeholders; complies with current laws and is consistent with international standards of behavior; and is integrated throughout the organization and implemented in its relations."*

Within the Dutch context, CSR is also known as Maatschappelijk Verantwoord Ondernemen (MVO). This means that the company is aware of the impact on people and the environment and take into account the effects of their business operations on people, the environment and society (Rijksoverheid, n.d.).

- **Social Sustainability**

Sustainability can also be described focusing on the social aspect alone. According to Eizenberg & Jabareen (2017), within the framework of sustainability, "social sustainability comprises socially oriented practices intended to address major social issues to cope with risks of climate change and environmental hazards". McKenzie (2004) defines social sustainability as "a positive condition within communities, and a process within communities that can achieve that condition. This definition is supplemented with corresponding principles including: equity of access to key services, equity between generations, a system of relations valuing disparate cultures, political participation of citizens, particularly at a local level, a sense of community ownership, a system for transmitting awareness of social sustainability from one, mechanisms for a community to fulfill its own needs where possible and political advocacy to meet needs that cannot be met by community action."

- **Environmental Sustainability**

Goodland (1995) mentions that the focus of environmental sustainability is "to improve human welfare by protecting the sources of raw materials used for human needs and ensuring that the sinks for human wastes are not exceeded in order to prevent hard to humans". Morelli (2011) defines environmental sustainability as "a condition of balance, resilience and interconnectedness that allows human society to satisfy its needs while neither exceeding the capacity of its supporting ecosystems to continue to regenerate the services necessary to meet those needs nor by our actions diminishing biological diversity".

The above section thus describes four main concepts of sustainability: Triple Bottom Line (TBL), CSR, Social Sustainability and Environmental Sustainability. For the purpose of this research study, the **Triple Bottom Line** is chosen as it gives equal importance to the three aspects/lines of sustainability that needs to be looked at: Social (People), Environmental (Planet) and Economic (Profit). The TBL concept is also chosen as within Fluor, sustainability is also defined in line with the TBL framework where it is mentioned that "TBL is another term for sustainability, referring to economic, environmental and social impacts. True sustainability is about getting the balance right across all three elements and their overlaps simultaneously" (Fluor internal document. n.d.)

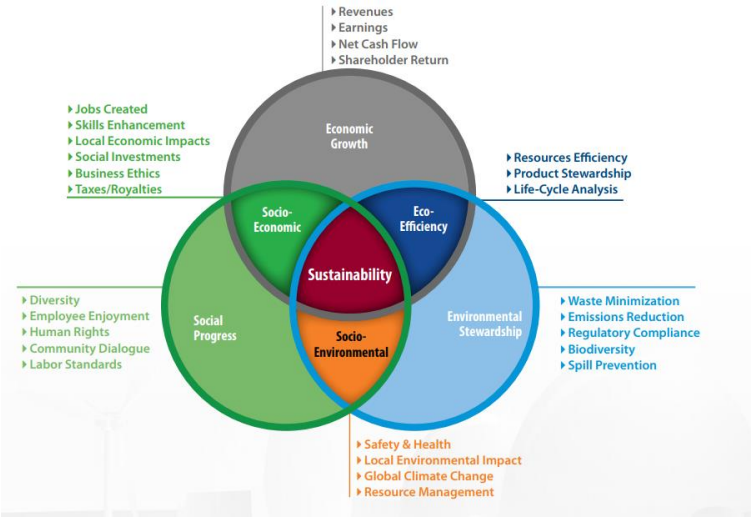

Figure 2.6: Triple Bottom Line {Retrieved from Fluor's Sustainability Policy, https://www.fluor.com/SiteCollectionDocuments/fluor-sustainability-policy.pdf)

2.2.2 Role of sustainability in the Oil, Gas & Petrochemical industry

The oil, gas & petrochemical (OG&C) industry plays a central role in both the global and national economies. Oil and gas are also key pillars of the global energy system and thus play an important role in sustainable development (UNDP, 2017). But the industry is faced with growing concerns of climate change, carbon emissions, ensuring employee health and safety, energy transition and many more. Many OG&C companies are using the UN's 17 Sustainable Development Goals (SDGs) as a guideline to drive sustainability within the organization. Thus, there is the potential to incorporate relevant Sustainable Development Goals (SDGs) into their business and operations thereby leading to greater efficiencies, cost savings and competitiveness (UNDP, 2017).

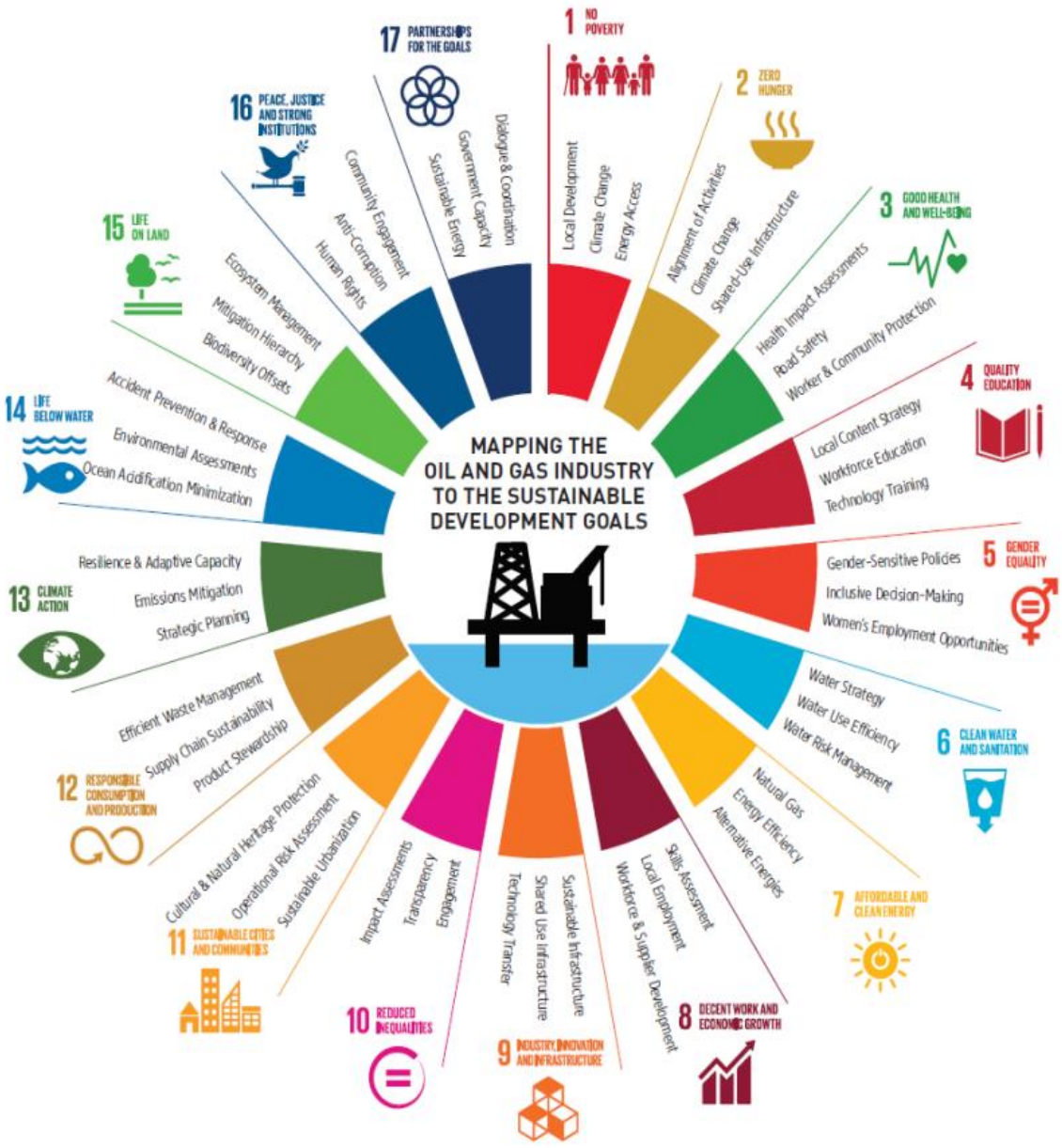

Figure 2.7: Key issue areas for oil and gas industry mapped to the SDGs [Retrieved from https://www.undp.org/publications/mapping-oil-and-gas-industry-sdgs-atlas.06-09-2022]

Thus, by incorporating sustainable goals or SDGs, OG&C companies can respond to consumer pressure, climate change, pressure from government and international bodies, access to capital/funding and the need for resilience, thereby addressing the different challenges within the industry (Peleg, 2021).

2.2.3 Benefits of integrating sustainability into procurement/supply chain

A company is only as sustainable as its supply chain (Krausse et al., 2009). The supply chain includes the downstream actors such as suppliers/vendors and other contractors, from whom EPC companies procure materials and services. There are several reasons why looking at sustainability within procurement or in the supply chain is beneficial to the company, such as:

- Currently companies are facing many disruptions within their supply chain due to the covid pandemic, material scarcity, energy prices and so on (Schuller, 2022). That in addition to backlash they may receive in case of environmental and social negligence makes aligning procurement practices with sustainability of high priority.
- Companies are also now looking closely into their GHG emissions. Within organization three main types of emissions can be identified. Scope 1 are the direct emissions caused due to the companies own activities including from owned or controlled sources. Scope 2 are the emissions caused from the generation of purchased energy and Scope 3 emissions are all indirect emissions that occur in the value chain of the company (Greenhouse Gas Protocol, n.d.). With Scope 3 emissions accounting for 50 to 80 percent of a company's total emissions, depending on industry, procurement has considerable potential to bring emissions and thus costs down (Schuller, 2022).
- Looking at supply chain decarbonization is also critical to help companies achieve their Net Zero ambitions. By embedding decarbonization expectations into existing procurement processes, companies can kick-start supply chain decarbonization in a cost effective and high impact manner (Wbcsd, 2022).
- Sustainable procurement strategies also give an opportunity to create sustainable and resilient supply chains that can help companies unlock new value, remain agile in the face of future crisis and comply with growing regulations and demand (Ecovadis, 2021)
- Looking at supply chain sustainability will also help companies understand risks, assess and monitor how their supply chain is managing those risks and also diversify their supply chain portfolio to reduce vulnerabilities (Jan, 2020).
- Sustainable supply chain management practices can assist companies in optimizing their end-to-end operations thereby achieving greater cost savings and profitability (Santosa, 2015). For example, costs can be reduced when companies invest in environmental management systems in their own organizations and in their supply chains, that result in lower accidental environmental releases and liability (Hasan, 2013). Organizations can also reduce their operating costs by including sustainability into their supply chains (Hasan, 2013). Organizations can also reduce costs associated with energy consumption, materials purchased, waste treatment, waste discharge and fines for environmental accidents (Zhu et al., 2008). Also reducing packaging materials will not only reduce packaging costs but also transportation costs and help organizations use their resources more efficiently (Carter et al., 2000).
- Companies will also be faced with increasing carbon tax in the coming years and looking at supply chain sustainability or sustainable procurement is one way in which the costs associated to carbon emissions can be reduced (Schuller, 2022)

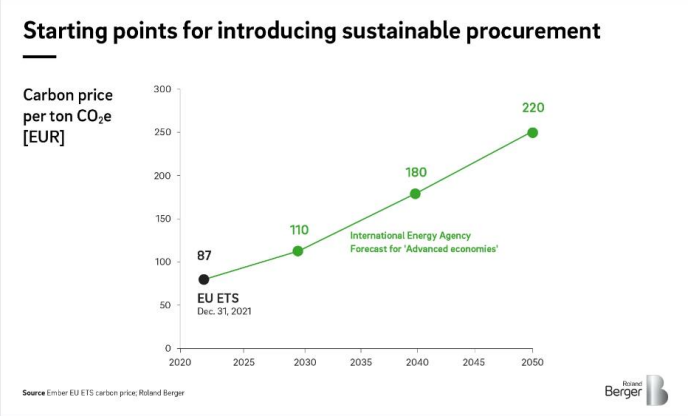

Figure 2.8: Carbon price forecast in upcoming years [Retrieved from https://www.rolandberger.com/en/Insights/Publications/How-companies-can-benefit-from-sustainable-procurement.html. 12 September 2022]

2.2.4 Identifying sustainability criteria (Environmental, Social & Economic) from academic literature

The characteristics of EPC companies within Energy & Chemicals industry and the concept of sustainability to be used throughout this research study, Triple Bottom Line (TBL) was determined in the previous sections. The next step involves identifying the sustainability criteria and performance indicators needed to assess the sustainability aspects of supply chain actors (suppliers/(sub-)contractors).

Procedure for identifying sustainability criteria from literature

First, a list of keywords was identified that would help gather the best suited data from academic sources. The keywords were formed based on the research questions and what the intended result of the literature review was. Thus, the main keywords selected were: sustainability, corporate social responsibility, procurement, sustainable procurement, supply chain, green supply chain, environmental criteria, social criteria, green purchasing, supply chain management, supplier selection, supplier evaluation , process industry, oil & gas, and projects. These keywords were then used in different academic databases such as: Google Scholar, Scopus, ScienceDirect, as well as for doing basic google searches using different keyword combinations. This search resulted in a set of academic literature identifying sustainability criteria and indicators that would add most impact during procurement or supply chain selection. Initially the focus of literature review was on the process industry alone, but due to limited literature available (as discussed in problem statement, section 1.5), the scope was extended to identify literature addressing selection and evaluation of supply chain actors from a holistic viewpoint. Finally, the literature was reviewed, and the information retrieved assimilated. This resulted in Table 2.1, which identifies the different social, environmental and economic criteria (sustainability criteria) and their corresponding performance indicators that would add most impact when integrated into an EPC's company's project procurement process.

Sustainability requirements can be managed with the help of different operational tools, e.g., sustainability criteria, sustainability standards, eco-labels and their combinations (Pavlovskaia, 2014).

Simply put, sustainability criteria is used to determine the sustainable quality of a product or service. They act as a point of reference to procure sustainably. According to Koplin et al. (2007), sustainability criteria in an environmental context form requirements placed on suppliers aiming to reduce the input of natural resources and minimize environmental risks by improving the efficiency of suppliers. In this research study, Koplin's argument will be expanded to also include the social and economic context and other involved actors such as (sub-)contractors. Performance indicators are used to reflect on the performance of the sustainability criteria. They are tools to check and evaluate the fulfillment of sustainability criteria, as well as the progress towards sustainability (Pavlovskaia, 2014). Performance indicators can be used for both quantitative measurement as well as qualitative assessment of the sustainability efforts of actors and its impact on the environment (National Research Council, 2010).

Goldschmidt et al (2013) underlines that sustainability criteria can be of a qualitative of quantitative nature. In this research study, the sustainability criteria and its performance indicators will be looked at from a qualitative perspective. It is also important to understand that sustainability criteria are not static and often require continuous assessment and modification over time (Pavlovskia, 2014; Goldschmidt et al., 2013). This research study focusses on qualitative assessment through the sustainability framework developed as a first step. Qualitative assessment is selected as it considers the level of complexity, looks at the larger picture and considers changing project requirements and drivers faced by the Energy & Chemicals/Process industry. It is also considered because currently in the Energy & Chemicals/Process industry, there are not many overall standards and norms evaluating the sustainability of suppliers/(sub-)contractors. Thus, using a qualitative approach through the developed sustainability framework, will act as a first detailed step to integrating sustainability into procurement practices within EPC companies, which can in the future be followed by quantitative measurement methods or standards/norms.

The summary of the procedure for conducting the literature review is described in Appendix A.1.

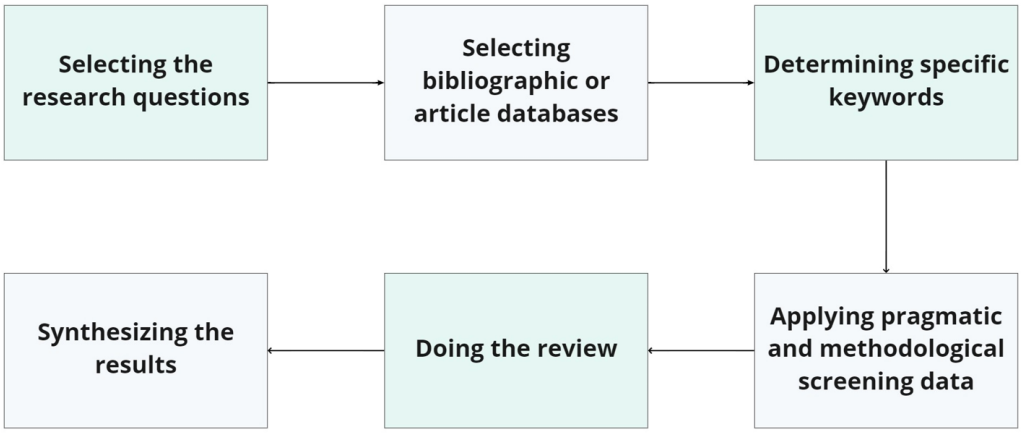

Figure 2.9: Procedure for literature review answering SQ2 [own illustration adapted from Fink (2014)]

Building the conceptual sustainability framework from academic literature

Table 2.1 depicts the holistic conceptual sustainability framework ("SF.1"- first sustainability framework) developed from academic literature. The sustainability criteria and the corresponding performance indicators identified are used to determine the potential requirements to be put forth to suppliers and (sub-)contractors, with the aim to reduce their impact on the environment and society thereby improving sustainability and efficiency. In this research study, the focus is on assessing the sustainability criteria and performance indicators qualitatively. But they can be measured quantitatively when possible or as per client/project requirements and goals.

Table 2.1: Conceptual 'sustainability framework' (SF.1) developed from literature review

	TBL aspect	Criteria	Performance indicators	References
1	ENVIRONMENTAL	Environmentally conscious purchasing	- Manage and reduce waste	Handfield et al. (2002); Min & Galle (1997); Humphreys et al. (2008); Tseng & Chiu (2013); Ghadge & Tiwari (2019)
			- Reduce and ultimately eliminate waste	
			- Maximize resource efficiency	
			- Environmental performance and purchasing function	
			- Green purchasing	
2		Green Supply Chain Management	- Suppliers' environmental responsibility	Handfield et al. (2002); Lee (2008); Zhu et al. (2005); Tundys (2016); Sarkis (1998); Bowen et al. (2001)
			- Second tier supplier environmental evaluation	
			- Supplier (SME) willingness to participate in green supply chain initiatives	
			- Suppliers advances in developing environmentally friendly goods	
			- Evaluation of direct and second-tier suppliers	
			- "Greening the supply process" activities	
			- Green supply chain management: Inbound logistics and procurement, Materials Management, Outbound logistics, Packaging, Reverse logistics	
			- Supplier management	
3		Environmental performance	- Opportunity for reducing activities (REDUCE)	Büyüközkan & Çifçi (2012); Noci (1997); Tuzkaya et al. (2009); Handfield et al. (2002); Humphreys et al. (2003); Williams (2003); Zhu et al. (2005); Wong et al. (2012); Tundys (2016); Ordoobadi (2009); Alfred & Adam (2009); Sarkis (1998); Holt et al. (2000); Sarkis (1998); Awasthi et al. (2010)
			- Opportunity to reuse (REUSE)/ Materials reusability capabilities	
			- Opportunity to recycling (RECYCLE) / Materials recyclability capabilities	
			- Opportunity to Remanufacture (REMANUFACTURE)	
			- Opportunity for Disposal and disassembly (DISPOSAL & DISSASSEMBLY)	
			- Capability for easy disassembly for remanufacturing	
			- Considerations to product design to include remanufacturing characteristics	
			- Consideration of products durability and disposal characteristics	
			- Availability and Implementation of clean technologies	
			- Environmental efficiency of its operating procedures	
			- Biodegradable/compostable (%)	
			- Contains no ozone depleting substances	
			- Emissions and waste (per unit of product)	
			- Pre/post-consumer recyclable content (%)	
			- Recyclable item (% of total)	
			- Design for the environment (recycle, reuse, remanufacture, disassembly, disposal)	
			- Use of environmentally friendly materials	
			- Natural resource use/Resources efficiency/ Control of consumption of resources (water, raw materials)	
			- Loss of biodiversity and deforestation	
			- Ozone depletion/Use of ozone depleting substances/ Reduction of use and emission of ozone depleting chemicals such as Chlorofluorocarbons (CFCs)	

	TBL aspect	Criteria	Performance indicators	References
	ENVIRONMENTAL		- Design of products for reduced consumption of materials	
			- Design of products for reuse, recycle, recovery of material, component parts	
			- Environmental impacts (at local, national, regional, and international levels)	
			- Types of materials used in manufacture of the product	
4		Pollution Control and Waste Management	- Pollution Control (pollution factors constituted from the supplier production and service processes and product components. Related with air emissions, wastewater, and solid wastes)	Noci (1997); Tuzkaya et al. (2009); Handfield et al. (2002); Humphreys et al. (2003); Williams (2003); Wong et al. (2012); Alfred et al. (2009); Holt et al. (2000); Awasthi et al. (2010)
			- Critical water wastes due to supplier's plants (COD, total nitrogen, phosphorous, dissolved salts)	
			- Emissions and waste (per unit of product)	
			- Pollution reduction capability	
			- Cost related to wastes (solid waste disposal costs, chemical waste disposal costs, wastewater treatment costs)	
			- Treatment costs for air pollutants (Sulphur dioxide, NOx)	
			- Minimize amount of air, water emissions	
			- Pollution control initiatives	
			- Reduction of wastes	
5		Management of hazardous substances	- Hazardous air emissions (CFC's, EtO, MEK, Toluene, etc.)	Handfield et al. (2002); Punniyamoorthy et al. (2011); Tuzkaya et al. (2009); Zhu et al. (2005); Lee (2008)
			- Hazardous waste	
			- Toxic waste pollution management	
			- Hazard and assessment records	
			- Cost for disposal of hazardous materials	
			- Design of products to avoid or reduce use of hazardous products and their manufacturing process	
			- Regulations on use of hazardous substances	
6		Life cycle Assessment	- Life cycle costs	Noci (1997); Tuzkaya et al. (2009); Lamming & Hampson (1996); Sarkis (1998); Tseng & Chiu (2013); Hsu et al. (2013)
			- Net life cycle costs (the cost of the purchase of the supplied component, the cost of component disposal or recovery at the end of its life, and depreciation associated with investments aimed at improving the supplier's environmental efficiency or at modifying its attitude versus environment related issues)	
			- Life Cycle Assessment	
			- Life cycle costing (LCC)	
			- Life Cycle Cost Management	
7		Environmental regulations/Environmental compliance	- State/Federal/Central government environmental regulations	Min & Galle (1997); Handfield et al. (2002); Tuzkaya et al. (2009); Zhu et al. (2008); Humphreys et al. (2003); Awasthi et al. (2010)
			- Environment related certificates (ISO 14000/ISO 14001)	
			- Public disclosure of environmental record	
			- Environmental compliance	
			- Pro-active environmental compliance	

	TBL aspect	Criteria	Performance indicators	References
8	ENVIRONMENTAL	Environmental Management Systems (EMS)	- Reverse logistics	Tuzkaya et al. (2009); Lee (2008); Zhu et al. (2008)
			- Transfer environmental management know-how to suppliers	
			- Existing environmental management systems	
9		Green process management	- Environmental performance of first and second tier suppliers	Tuzkaya et al. (2009)
10		Energy efficiency	- Resources and energy (per unit of product)	Handfield et al. (2002); Tundys (2016); Williams (2003); Tuzkaya et al. (2009); Noci, G. (1997) Wong et al. (2012); Zhu et al. (2008); Sarkis (1998); Humphreys et al. (2003)
			- Total energy used	
			- Use of renewable energy	
			- Energy consumption (minimizing)	
			- Design of product for reduced consumption of energy	
			- Amount of energy and efficiency required for the products manufacture and assembly	
			- Environmental costs related to energy	
11		GHG emissions/Carbon footprint/ Carbon management	- Reduction in the emission of CO2 and other global warming gases	Holt et al. (2000); Alfred & Adam (2009); Wong et al. (2012); Shaw et al. (2012); Hsu et al. (2013)
			- Carbon/GHG emissions	
			- Carbon policy	
			- Carbon reduction targets	
12		Product stewardship	- Design for the environment (recycle, reuse, remanufacture, disassembly, disposal)	Sarkis (2001); Lamming & Hampson (1996)
			- LCA	
13		Green competences	- Availability of clean technologies	Noci (1997)
			- The type of materials making up the supplied component	
			- Capacity to respond in time to product or process modifications	
1	SOCIAL	Employment practices	- Corporate code of conduct	Gauthier (2005); Presley et al. (2007); Baskaran et al. (2012); Williams (2003); Labuschagne et al. (2005);
			- Dialogue with employees	
			- Employee satisfaction	
			- Training hours utilized per employee	
			- Working hours	
			- Employee privacy	
			- Investment in education/training	
			- Employment stability	
			- Job opportunities	
			- Equity	
			- Career development	
2		Health and safety	- Meet occupational health and safety criteria for employees and customers	Gauthier (2005); Presley et al. (2007); Labuschagne et al. (2005); Punniyamoorthy et al. (2011); Tundys (2016); Amindoust et al. (2012); Emrouznejad & Tavana (2013)
			- Exposure to harmful materials or process	
			- Health and safety practices and incidents	
			- Usage of PPE's	
			- Incident/Accident records	
			- Work safety and labor health	

	TBL aspect	Criteria	Performance indicators	References
3	SOCIAL	Local Community Influence	- Burden to community	Presley et al. (2007); Labuschagne et al. (2005); Williams (2003); Nikolaou et al.2013)
			- Number of community complaints	
			- Public services	
			- Investment in local community	
			- Local community involvement	
4		Stakeholder's influence	- Stakeholder relations	Gauthier (2005); Presley et al. (2007); Labuschagne et al. (2005); Punniyamoorthy et al. (2011); Tundys (2016); Amindoust et al. (2012); Nikolaou et al. (2013)
			- Stakeholder participation	
			- Stakeholder empowerment	
			- Information provision	
5		Company efforts	- Environmental image of company	Tuzkaya et al. (2009); Noci (1997);
			- Social responsibility efforts	
			- Training and programs for employees for green consciousness	
			- Customers purchase retention	
			- Type of relationships with stakeholders	
			- Market share related to 'green' customers	
6		Discrimination	- Discrimination in employment (age, religion, gender, and other similar factors)	Tundys (2016); Baskaran et al. (2012); Charter et al. (2001); Kolk & Van Tulder (2002); Williams (2003); Gauthier (2005)
			- Racial or sexual discrimination	
7		Child/Forced labor and rights	- Child labor	Kolk & Van Tulder (2002); Williams (2003); Baskaran et al. (2012); Tundys (2016)
8		Contribution to society	- The interests and rights of employees	Tundys (2016); Amindoust et al. (2012)
			- The rights of stakeholders	
1	ECONOMIC	Cost/Price	- Initial price	Tundys (2016); Amindoust et al. (2012); Chou & Chang (2008); De Boer et al. (2001); Huang & Keskar (2007); Abdollahi et al. (2015); Punniyamoorthy et al. (2011); Hashemi et al. (2015)
			- Profitability	
			- Unit price	
			- Cost reduction plan/capability	
			- Cost of using the supplier	
			- Investment, Order, Direct, Logistics, Manufacturing, Warehouse costs	
			- Product price	
			- Payment terms	
			- Competitive price	
			- Fluctuation on costs	
			- Total cost of shipments	

	TBL aspect	Criteria	Performance indicators	References
2	ECONOMIC	Quality	- Product quality	Tundys (2016); Chou & Chang (2008); De Boer et al. (2001); Huang & Keskar (2007); Ordoobadi (2009); Chamodrakas et al. (2010); Abdollahi et al. (2015); Punniyamoorthy et al. (2011)
			- Customer rejection rate	
			- Quality certifications acquired	
			- Quality control rejection rate	
			- Customer rejection rate	
			- Warranties and claim policies	
			- Product durability	
			- Product performance	
			- ISO certification status	
			- Total quality management	
			- Product performance and conformance to standards	
			- Rejection rate in the incoming quality control	
			- Repair and return rate	
			- Feedback from customers	
3		Technological capability	- Technical capability	Tundys (2016); Chou & Chang (2008); De Boer et al. (2001); Punniyamoorthy et al. (2011)
			- Technology and Innovation	
			- Technical problem solving	
			- Intelligent software tools	
			- Design capability	
			- Collaboration with research institutes	
			- Quick response capacity of product research and development	
4		Production facilities and capacity	- Product facilities and capacity	Tundys (2016); Keskin et al. (2010); Punniyamoorthy et al. (2011)
			- Adequate production capacity	
			- Process and Volume flexibility	
			- Training	
			- Handling and packaging capability	
			- Machine capability and capacity	
			- Facilities for measurement, calibration and testing	
5		Financial capability/position	- Financial abilities of organization	Tundys (2016); Punniyamoorthy et al. (2011)
			- Financial stability	
			- Credit strength	
			- Financial records disclosure with growth rate	
6		Organization and management	- Reputation and Position in industry	Tundys (2016); Chou & Chang (2008); Punniyamoorthy et al. (2011)
			- Prior experience with vendor/supplier	
			- Physical size of organization	
			- Geographical location	
			- Reputation and position in industry	

	TBL aspect	Criteria	Performance indicators	References
	ECONOMIC		- Ethical standards	
			- Educational qualification of human resources	
			- Strategic fit	
			- Management capability	
7		Delivery	- Short delivery lead time	Tundys (2016); Punniyamoorthy, et al. (2011); Chou & Chang (2008); De Boer et al. (2001); Huang & Keskar (2007); Chamodrakas et al. (2010); Ordoobadi (2009); Abdollahi et al. (2015)
			- Production lead time,	
			- Delivery reliability	
			- Safety and security of components	
			- Appropriateness of the packaging standards	
			- Flexibility	
			- On time delivery/delivery capability	
			- Compliance with due date	
			- Compliance with quantity	
8		Service	- Level of service	Punniyamoorthy et al. (2011); Ordoobadi (2009)
			- Reliability	
			- Empathy	
			- Responsiveness	
			- Assurance	
9		Flexibility	- Process flexibility	Punniyamoorthy et al. (2011); Zhu et al. (2010); Tseng & Chiu (2013)
			- Volume flexibility	
			- Supplier flexibility	
10		Relationship	- Long term relationship	Punniyamoorthy et al. (2011); Zhu et al. (2010); Tseng & Chiu (2013)
			- Level of trust and understanding	
			- Share sensitive information like financial, production, supplier's customer base	
			- Supplier-buyer relationship	

2.3 Chapter 2-Literature Review conclusion and next steps

The main aim of literature review was twofold: first, to understand the characteristics of EPC companies within the E&C industry (answering SQ1). Second, to develop a conceptual sustainability framework to assess the sustainability level of supply chain actors (suppliers/(sub-)contractors) (answering SQ2).

The goal of understanding the characteristics of EPC companies within the E&C industry was to provide a basis for the research study and help understand the context in which the research is conducted. Understanding the attributes of EPC companies includes understanding the main project delivery methods used (EPC & EPCM), understanding the typical project life cycle of an E&C project, the contract types used (cost reimbursable, lumpsum, unit rate) and a typical procurement process. By exploring the concepts of EPC and EPCM, the advantages, dis-advantages, and risks of using each project delivery method was studied. Similarly, the typical E&C project lifecycle was studied to understand the different project phases and activities involved within an Oil, Gas and Petrochemical project. This was followed by understanding the different contract types that are used in E&C projects such as cost reimbursable, lumpsum and unit rate, as well as well as a typical procurement process within the industry. Gaining insight on these topics not only helps answer SQ1, but also provides knowledge on how projects are executed by EPC companies in the E&C industry and the traits specific to this industry. This will ensure that context in which this research is conducted, and the basis of the upcoming chapters is clear and well understood.

In order to assess the sustainability level of an EPC company's suppliers/(sub-)contractors, first the sustainability concept or definition that will be used to define sustainability in this study was identified. The different concepts of social sustainability, environmental sustainability, corporate social responsibility (CSR) and the triple bottom line (TBL) were explored. Finally, the Triple Bottom Line (TBL) concept of sustainability was chosen as it places equal level of importance to all the three dimensions of sustainability: social, environmental, and economic. The TBL concept is also used within the case company, FCBV, hence strengthening the choice. This was followed by exploring the role of sustainability in the oil, gas & petrochemical industry, along with the benefits of looking at sustainability in procurement/supply chain. Benefits such as reducing GHG emissions and thereby associated costs, opportunity to create resilient supply chains, optimizing operations thus achieving higher cost savings and profitability, among others were explored in detail. This was followed by the identification of sustainability criteria and performance indicators that can be used to assess the sustainability level of an EPC company's suppliers/(sub-) contractors. Sustainability criteria, in this research study, is used to define the requirements that can be put towards supply chain actors aiming to assess their sustainability practices and efforts. Performance indicators are tools that are used to determine how and if the sustainability criteria have been achieved. The sustainability criteria and performance indicators were identified from various academic sources relating to the selection and evaluation of supply chain actors regarding their sustainability efforts. The sustainability criteria and performance indicators identified helped determine the sustainability efforts or requirements to be placed on suppliers/(sub-)contractors to improve their sustainability performance and efficiency. A total pf 13 environmental criteria and 83 corresponding performance indicators, 8 social criteria and 37 corresponding indicators and 10 economic criteria and 73 corresponding performance indicators were identified. This resulted in the development of a conceptual sustainability framework (SF.1 from literature) that can be potentially integrated into the procurement practices of EPC companies. It is important to note that the framework was developed from a qualitative

perspective as there are currently not many industry wide measurement standards regarding sustainability in the E&C industry.

In the upcoming chapter (Chapter 3-Document review), a similar process to the literature review will be conducted. The aim is to understand the characteristics of the case EPC company (FCBV), as well as develop a sustainability framework based on reviewing case company documents. This will ensure that the sustainability framework developed has a base in both academic literature as well as practice. This is followed by combining and synthesizing the conceptual sustainability framework developed from literature and document review into a single framework. This will later be prioritized and validated during the semi-structured interviews (as described in subsequent chapters), to link practice and literature and effectively integrate it into the procurement practices in projects.

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CHAPTER 3

DOCUMENT REVIEW

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CHAPTER 3: DOCUMENT REVIEW

This chapter presents the results of the document (Fluor internal) review. The outcome of this chapter provides an understanding, from the case company perspective, of the characteristics of an EPC company and adds to the conceptual framework developed in chapter 2, thus contributing to answering:

SQ1 What are the characteristics of EPC companies within the Energy & Chemicals/Process industry?

SQ2 How can EPC companies assess the sustainability level of their suppliers/(sub-)contractors?

This chapter is structured as follows: SQ1 is answered in the context of the case company FCBV by exploring the attributes of the company (3.1). This includes understanding the project delivery method used within FCBV in the Netherlands (3.1.1), the preferred contract types at FCBV (3.1.2) and the procurement process carried out at FCBV (3.1.3). In order to add to the conceptual framework developed in chapter 2 and ultimately answer SQ2, section 3.2 will study Fluor internal documents to identify sustainability criteria and indicators and ultimately develop the conceptual sustainability framework from document review (3.3). Finally, the chapter summary and next steps are described (3.4).

3.1 Attributes of an EPC company (in the context of FCBV)

3.1.1 Project contract strategies in FCBV

In the previous chapter, section 2.1.1 described in detail the two project delivery methods commonly used in the Energy & Chemicals industry-EPC and EPCM. In the context of Fluor Consultants B.V. (FCBV) in the Netherlands the EPCM project delivery method is preferred. In the EPCM method at FCBV in the Netherlands, the client has an EPCM contract with the main EPC contractor (FCBV), who then carries out agreements with construction subcontractors, vendors and specialized services, for and on behalf of the client (Figure 3.1). These include subcontracts for the construction services and other specialized services, and purchase orders for the vendors/suppliers. In majority of the cases, the client/owner signs the contracts and the PO's, which means that majority is on 'client paper'.

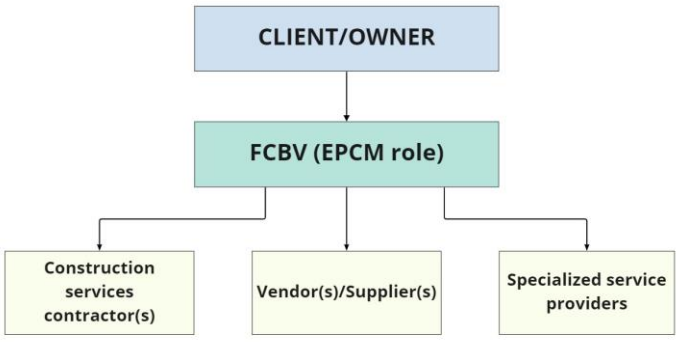

Figure 3.1: FCBV in an EPCM role [own illustration]

There are several reasons why the EPCM method is chosen at FCBV. These include:

- It reduces the risk faced by FCBV, as majority of the risk and liability falls with the client.
- The clients within FCBV also prefer the EPCM method as they can retain control and be more involved in the project execution. They approach FCBV mainly for their knowledge and expertise in the field.
- These clients also value long term relations and collaborations making the EPCM method more suitable.

3.1.2 Contract types used in FCBV

It is important to note that within the context of FCBV, the upstream contracts or prime contracts include 'cost reimbursable' or 'lumpsum' contracts/pricing methods. Upstream or prime contracts are between EPC contractor-FCBV and the client/owner. While the downstream contracts or (sub-)contracts include 'cost reimbursable', 'lumpsum' or 'unit price/unit rate' contracts. Downstream contracts are between the client and the (sub-)contractors and the contracts are drawn by the EPC contractor-FCBV, for and on behalf of the client (i.e., on client paper). These different contract types are explained in detail in section 2.1.3.

In majority of the projects within FCBV, preferred upstream/prime contracts are 'cost reimbursable' and 'lumpsum' contracts. While the most commonly used downstream/(sub-)contracts are 'unit price/unit rate' contracts.

3.1.3 EPC company procurement process

The goal of this section is to gain insight into the basics of the procurement process carried out within FCBV. The procurement practices will be explained in the context of the case company FCBV, as this will also provide context to the subject matter which is focused on integrating sustainability into the procurement practices of an EPC company such as FCBV.

Procurement within FCBV is defined as "the work process of planning and execution of cross-functional activities, to ensure that all materials and services are timely available, as per the specified quality requirements, in a cost-effective manner, to support construction." (Fluor internal training document, n.d.). Within FCBV, the procurement process is divided into two: Material Management (MM) and Contract Management (CM). Material management refers to acquiring of materials/equipment/package units from suppliers, while Contract Management refers to acquiring of services or labour (temporary labour) from contractors.

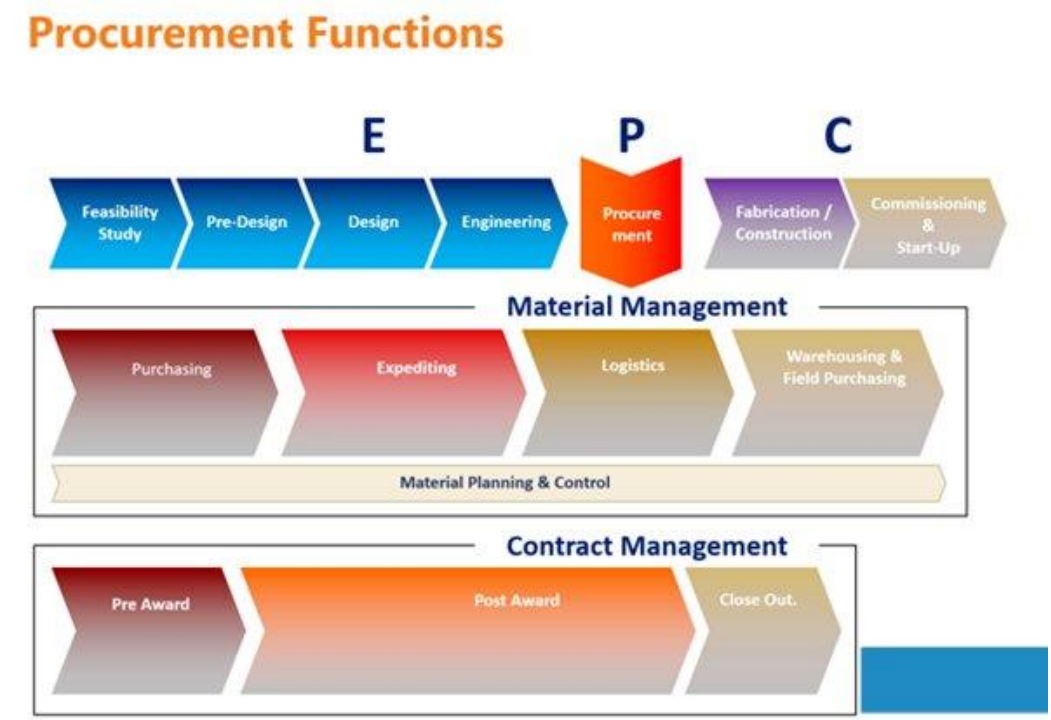

Figure 3.2: Overview of procurement functions within FCBV (Retrieved from Fluor internal training document, n.d.)

Material Management (MM)

In **Material Management (MM)**, the procurement functions include purchasing, expediting, logistics and warehousing & field purchasing (Figure 3.2). In order to first select a supplier, RFQ's or Request for Quotations are sent out, and once a supplier is selected and finalized, a PO or purchase order is sent out. This is part of the purchasing function. Once purchasing is done, expediting takes place in order to ensure that the suppliers meet the delivery promises made and deliver as per PO requirements. This means delivering the right quantities, to the right location, in support of the project schedule and in accordance with the terms and conditions of the purchase order. Logistics is the process of planning, implementing, and controlling the most efficient, cost-effective transport (and possible intermediate storage) of materials from the seller to jobsite for meeting the EPC company's requirements (Fluor internal training document, n.d.). Warehousing mainly involves the storage of the materials/equipment/package units required for the project and field purchasing involves the same material management functions but focuses on mainly field implementation in support of the construction contractors.

The standard procurement work process involves first defining the strategies. Once defined, a project bidders list is assembled consisting of a list of suppliers who could potentially carry out the work. The work involves supplying of materials/equipment. Sometimes clients also have preferred suppliers who they would want the work awarded to. Once the RFQ bidders list is assembled, RFQs to suppliers are issued. Once the bids are received, an initial evaluation takes place to check technical compliance and commercial fit. The suppliers best suited for executing the works are then shortlisted. This is followed by a detailed evaluation. Once the evaluation is complete, bid clarification meetings take place if necessary to gather additional information from the bidders regarding any aspects mentioned in the proposal that was

unclear. After that, the bid is summarized and mentioned to the client, including recommendation on who should be awarded the work. Once approved, this is then followed by a purchase order (PO). An overview of the standard purchasing work process is shown in Figure 3.3.

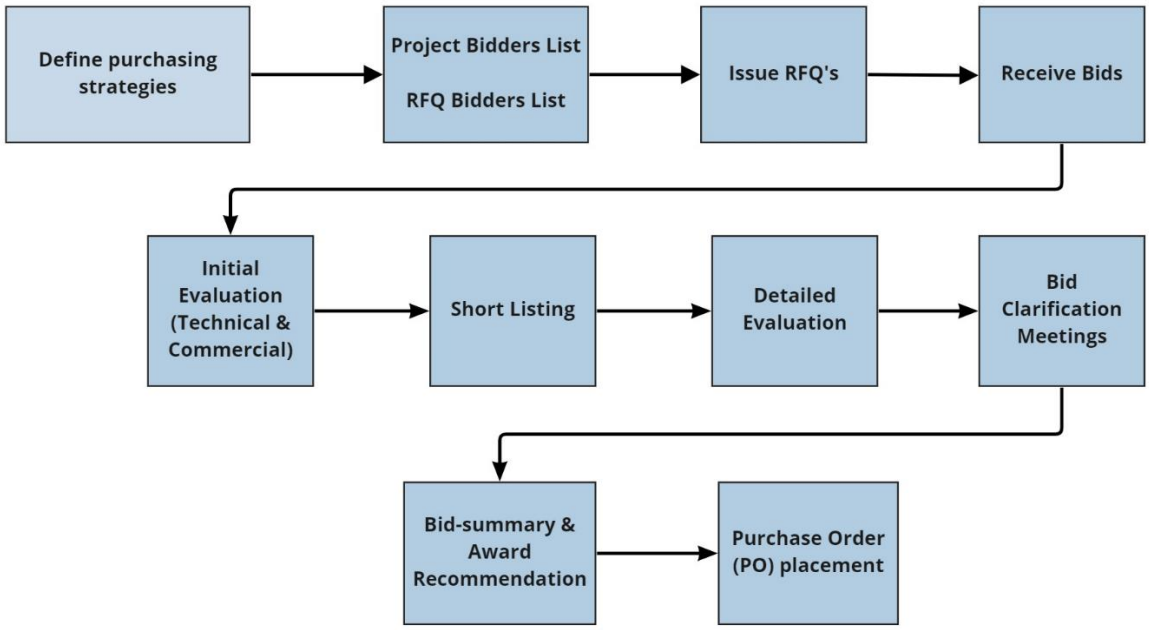

Figure 3.3: Standard MM/Purchasing Work Process [Adapted from Fluor internal training document, n.d.]

Contract Management (CM)

In contract Management (CM), pre-award, post-award and close-out are the three phases that each contract under a project can have (Figure 3.2). The standard pre-award contract management work process is similar to the MM work process. It involves first defining the contracting strategies. Once defined, a project bidders list is assembled consisting of a list of contractors who could potentially carry out the work. Sometimes clients also have preferred contractors who they would want the work awarded to. Once the RFP bidders list is assembled, RFPs to contractors are issued. Once the bids are received, an initial evaluation takes place to check technical compliance and commercial fit. The contractors best suited for executing the works are then shortlisted. This is followed by a detailed evaluation. Once the evaluation is complete, bid clarification meetings take place if necessary to gather additional information from the bidders regarding any aspects mentioned in the proposal that was unclear. After that, the bid is summarized and mentioned to the client, including recommendation on who should be awarded the bid. Once approved, this is then followed by a contract award, also known as the sub-contract. Within FCBV, the term 'sub-contract- often mean the agreement between Fluor and its contractors (Fluor internal document, n.d.). But this can be subject to change based on the context of the project and client definition of terms used. An overview of the standard pre-award contracting work process is shown in Figure 3.4.

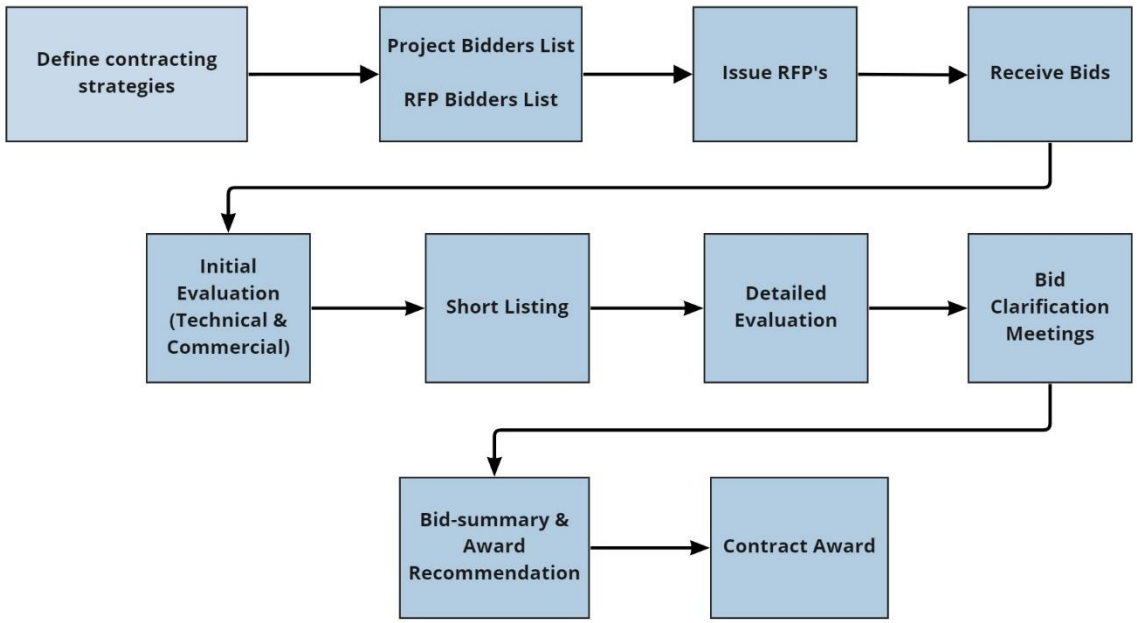

Figure 3.4: Standard pre-award contract management work process [Adapted from Fluor internal training document, n.d.]

Once the sub-contract is signed, the next phase is post-award. The post award contract management activities include getting ready for the contractor to begin work at the construction site. This can include pre-construction kick off meetings, construction schedule and manpower planning, discussing insurance requirements and starting regular progress and commercial meetings (Fluor internal training document, n.d.). It also includes coordinating contractor's invoice approvals and managing contract changes and contractor claims. The close out phase involves the process of accepting the work of the contractors and ensuring that there will be no future claims.

3.2 Identifying sustainability criteria (Environmental, Social & Economic) from document review

Aim:

Once literature review was completed, an overview on the theme of the documents to be studied was understood. The goal of document review was to identify mentions of sustainability across the various Fluor documents. The document review was undertaken to understand what aspects of sustainability, in either general ambition documents, guidelines, practices, procurement documents or others, were given focus within the Fluor organization. All sustainability documents available were reviewed in order to get a more holistic view in the sustainability aspects within Fluor. The information gathered will thus provide a practical backing to the information gathered from literature review.

Sample:

Overall, 37 documents were retrieved from the Fluor knowledge-management-system (KnowledgeOnline), which is a platform where different documents relating to Fluor are shared. The documents were selected based on whether sustainability was mentioned in them. These include guidelines, practices, ambition documents, future strategies, etc. The documents collected fall under four broad categories: **Fluor office & corporate documents**, **Fluor supply chain documents**, **Fluor HSE documents** and **Fluor external documents** (summary of the documents reviewed can be seen in Appendix B.2). The documents can be broadly classified as **Fluor Documents (FD's**). From the FD's, the goal was to select all mentions of sustainability, and compare it with the sustainability aspects gathered from literature review (Table 2.1) which were specific to supply chain. This ensured that the sustainability framework developed will be supported by company practices and specific to supply chain.

Analysis:

While analyzing documents, it is possible to only consider parts of the document or view the entire document as a whole (Bowen, 2009). In this research study, the entire document was reviewed to select aspects of sustainability mentioned in them. Similar criteria categories were hence used so that the frameworks developed from both literature and document review could be compared and collated into a single sustainability framework. The procedure for conducting document review is summarized in Figure 3.5 and elaborated in Appendix B.1.

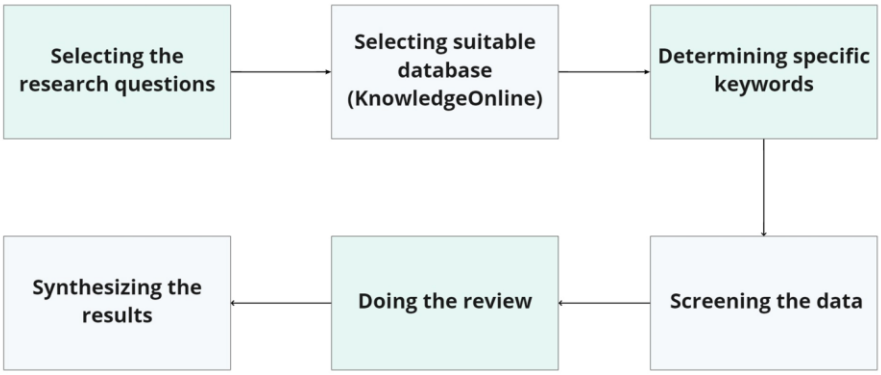

Figure 3.5: Procedure for conducting document review answering SQ2[own illustration adapted from Fink (2014)]

Building the conceptual sustainability framework from document review

Appendix B.2 provides a short description on the documents reviewed and Table 3.2 (depicted below) depicts the holistic conceptual sustainability framework developed from case company document review.

Table 3.1: Conceptual 'sustainability framework' (SF.2) developed from document review

	TBL aspect	Criteria	Performance indicators
1	ENVIRONMENTAL	Environmentally conscious purchasing	- Green procurement
			- Responsible sourcing
			- Local, green purchases
2		Green Supply Chain Management	- Sustainable procurement within supply chain
			- Engage Tier 1 indirect suppliers to create sustainability standards for downstream supply chain
			- Develop sustainability audit template for indirect and direct supply chain
			- Provide instruction to offices to source sustainable materials and purchases
			- Prepare sustainability standards that can be used in contracts and purchase orders
			- Engage Tier 1 indirect suppliers to create sustainability standards for downstream supply chain
			- Develop sustainability audit template for indirect and direct supply chain
			- Instruction to offices to source sustainable materials and purchases
			- Prepare sustainability standards that can be used in contracts and purchase orders
3		Environmental performance	- Waste minimization
			- Biodiversity
			- Spill prevention plans (plans+methods of containment for different spills and spill response to different substances)
			- Local environmental impact
			- Resource management (Long term operational and deconstruction resource usage)
			- Resources efficiency
			- Environmental stewardship (processes and technologies focusing on increased environmental stewardship)
			- LEED certification
			- Ecovadis certification (evaluation of how well a company has integrated the principles of Sustainability/CSR into their business and management system)
			- Water management and conservation (reduction in water consumption through operations/equipment)
			- Sustainable consumption
			- Use of conflict minerals (tin, tungsten, tantalum, gold)
			- Recycling policies
			- Volume of waste sent to landfill
			- Percentage of recycled materials used
			- Environmental considerations made
			- Land use
			- Alternate sustainable materials

	TBL aspect	Criteria	Performance indicators
	ENVIRONMENTAL		- Lean construction (Minimizing site footprint, minimizing disruptions and fuel usage, reduction of waste factors in orders)
			- Reduce, Reuse, Recycle, Remanufacture
			- Renewable fuels
			- Material efficiency
			- Environmental protection requirements
			- Erosion control measures
4		Pollution Control and Waste Management	- Local pollution (e.g., spills, accidental pollution)
			- Actions regarding hazardous materials and wastes
			- Waste reduction policies
			- Pollution control (Noise, Air, Vibration, Soil, Odor)
			- Waste reduction strategies: 1)Can waste be recycled rather than sent to a landfill? 2)Can disposal in landfills or incinerators be minimized? 3)Can unused materials be returned to suppliers? 4)Can equipment packaging be returned to suppliers? 5)Can environmentally preferred products (ones that are easier on the environment) be used?)
			- Site waste management plan
			- Waste minimization plans 1)Eliminating equipment pieces or connections where possible 2)Modifying or replacing standard equipment pieces, for example, using seal-less pumps 3)Using design practices that provide early detection of losses (e.g., aboveground tanks and piping) 4)capture and recycle to prevent or minimize waste generation 5)carry out 'process stream inventory" to consider streams with potential to generate waste)
			- Air emission sources and control
			- Liquid effluent sources and control measures
5		Management of hazardous substances	- Management of hazardous wastes
			- Disposal of hazardous wastes
			- Hazardous chemicals management (requirements facilitating safe handling, use, storage and disposal of hazardous chemicals/materials/substances)
6		Life cycle Assessment	- Life cycle Analysis
7		Environmental regulations/Environmental compliance	- ISO 14000/ISO 14001/ EMAS/ AS NZS ISO 14001
			- Environmental compliance with environmental laws and regulations
8		Environmental Management Systems (EMS)	- Certified environmental management standards
			- ISO 14000/ISO 14001/ EMAS/ AS NZS ISO 14001
			- EMS Program Development, Implementation, and Evaluation 1)Pollution Prevention and Waste Minimization Programs

	TBL aspect	Criteria	Performance indicators
	ENVIRONMENTAL		2)Sustainability Programs 3)Energy Efficiency Programs 4)Air, Water, and Soil Monitoring 5)Permit and Consent Coordination 6)Air Dispersion Modeling 7)Environmental Impact Assessment 8)Spill Prevention/Control Countermeasure Planning 9)Environmental Audit/Assessments 10)Waste Disposal Planning
10		Energy efficiency	- Reduction in energy consumption
			- Energy usage in offices
			- Pursue and purchase renewable/clean energy
			- Replacing inefficient equipment
			- Direct energy use (for natural gas, diesel, gasoline)
			- Indirect energy use (for electricity)
11		GHG emissions/Carbon footprint/ Carbon management	- Carbon reduction in project execution, operations and maintenance
			- Evaluating emission reduction controls
			- Reduction in GHG emissions
			- GHG emissions from offices (scope 1 and 2)
			- Carbon pricing (external costs of GHG emissions)
			- Carbon capture technologies (pre and post combustion carbon capture)
			- Carbon footprint management
			- Scope 1, 2, 3 emissions
12		Environmental stewardship	- Evidence of planning, instruction, and supervisory oversight of environmental hazard analysis
			- Identification of hazards should be visited periodically and addressed
			- Identification and mitigation of activities that can cause environmental nuisance
1	SOCIAL	Employment practices	- Diversity
			- Employee enjoyment
			- Labor standards
			- Working conditions such as working hours
			- Employee wages and benefits
			- Career management
			- Jobs created
			- Diverse and local suppliers/contractors/workers
			- Training and education for employees/suppliers
			- Equal opportunity/Equity/Equality
			- Security and welfare practices
			- Inclusion

	TBL aspect	Criteria	Performance indicators
	SOCIAL		- Ethics
			- Labor relations
			- Productive employment
			- Decent work
			- Welfare provisions
2		Health and safety	- Health and safety of employees and community
			- Operational facilities are ISO 45001/ OHSAS 18001 certified
			- Accident prevention
			- Exposure to health risks
			- Safety total case incident rate (TCIR)
3		Local Community Influence	- Hiring local workforce
			- Skills enhancement of local workforce
			- Community dialogue and engagement
			- Community Social Responsibility program
			- Community Infrastructure and relationships
			- Social progress
4		Company efforts	- Supplier social assessment
			- Supplier environmental assessment
5		Discrimination	- Discrimination and harassment
6		Child/Forced labor and rights	- Measures to prevent or eradicate child or forced labor
7		Employee and stakeholder rights	- Human rights
			- External stakeholder human rights (eg local communities, civil society)
			- rights of indigenous people
8		Contribution to society	- Tools and resources to support community building, charity, volunteering
1	ECONOMIC	Cost/Price/Revenue	- Low operating costs
			- Rate of return and profits
			- Earnings
			- Net cash flow
			- Shareholder return
			- Economic performance (Revenues, cost of revenues, cost of capital, dividends)
			- Revenues
			- Purchase orders with local suppliers/contractors
			- Costs associated with waste treatment/disposal
			- Financial statements
			- Turnover, Credit
			- Cost effectiveness

	TBL aspect	Criteria	Performance indicators
	ECONOMIC		- Usage costs
			- Total lifetime cost of ownership (TLCO)
			- Purchase price
2		Quality	- Supplier quality systems
			- Product quality
			- Quality management systems
			- ISO9001 certified
			- Product life expectancy
3		Technological capability	- Technical capabilities of suppliers
			- New technology
			- Access to technical equipment for environmental protection
			- Technical ability to meet green criteria
4		Financial capability/position	- Financial stability
5		Organization and management	- Company performance
			- Capabilities
			- Regional presence
			- Regional advantage
			- Competitiveness of organization
			- Anti-competitive behavior (awareness training and audits of control procedures)
			- Corruption and bribery (due diligence practices and audits of control procedures, anti-corruption policies)
			- Responsible marketing
			- Market presence
			- Accurate, complete, fair, timely, transparent and understandable financial and operational books records and accounts
			- Public image and customer relation
			- Legal liabilities
			- Productivity
			- Green suppliers in bidders list
			- Code of conduct
6		Relationship	- Hiring and training local workers
7		Local economic aspects	- Using local suppliers and contractors

3.3 Developing the conceptual "Sustainability Framework"

Table 2.1 (section 2.2.4) and Table 3.1 (section 3.2) shows the sustainability framework developed from literature and document review. These two frameworks (SF.1 & SF.2) are then compared and compiled into a single sustainability framework, by combining similar indicators and removing duplications.

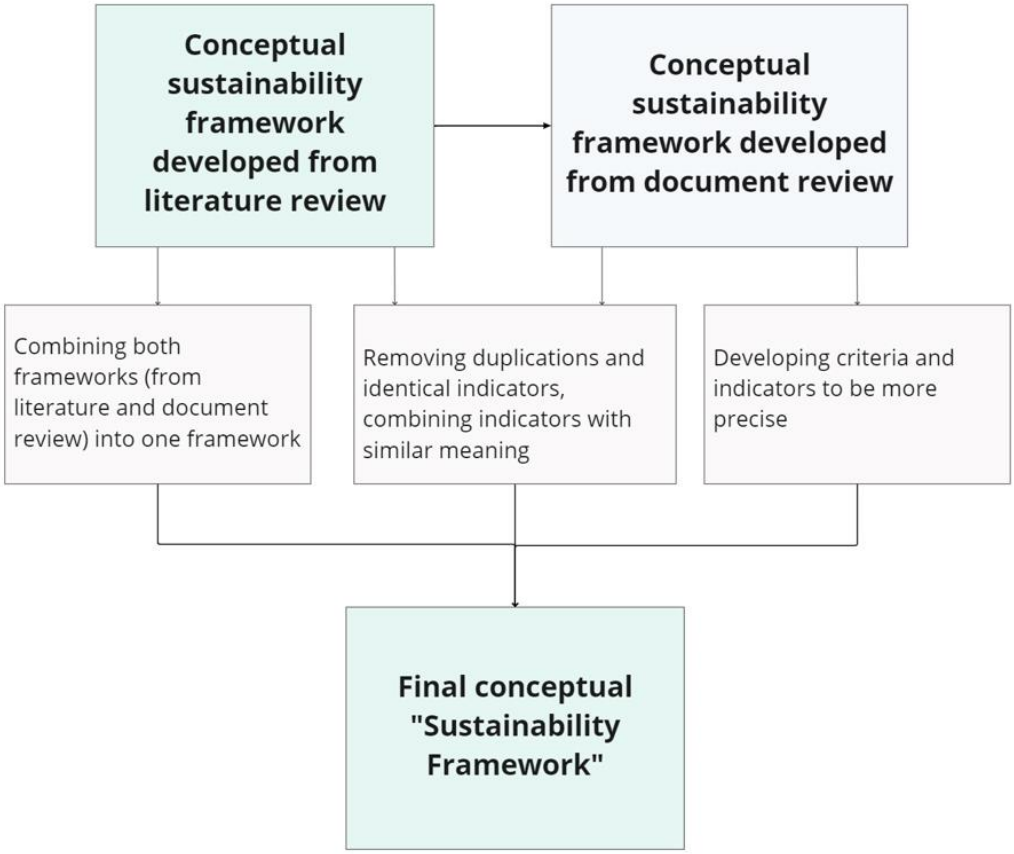

Figure 3.6: Steps to developing the conceptual sustainability framework from literature and document review

Once the combined conceptual framework was developed, an initial validation was done by requesting feedback from company supervisor. An observation was made that the economic aspects mentioned in the framework, were already covered in FCBV's day to day procurement practices. Hence, to avoid duplication, in the context of FCBV (the case company), the **focus** within the conceptual sustainability framework will be in the **environmental and social aspects of sustainability**. Table 3.2 thus depicts the final conceptual sustainability framework developed after comparing and combing the frameworks developed from literature and document review. A total of 12 environmental criteria and 33 performance indicators and 9 social criteria and 22 performance indicators make up the combined conceptual sustainability framework (SF.3). The subsequent chapters will thus focus on the environmental and social aspects of sustainability.

Table 3.2: Combined conceptual "Sustainability Framework" (SF.3 developed from combined literature and document review)

TBL aspect	Criteria	Performance indicators
ENVIRONMENTAL	**Environmentally conscious purchasing (E1)**	Green purchasing/Green procurement (E1.1)
		Responsible and local sourcing (E1.2)
		Maximize resource efficiency (E1.3)
	Green Supply Chain Management (E2)	Suppliers (Tier 1, Tier 2) environmental responsibility and performance (Inbound logistics and procurement, Materials Management, Outbound logistics, Packaging, Reverse logistics) (E2.1)
	Environmental performance (E3)	Material efficiency-Opportunity for material Reduce, Reuse, Recycle, Remanufacture and Disposal and Disassembly (E3.1)
		Local environmental impact (E3.2)
		Environmental stewardship (processes and technologies focusing on increased environmental stewardship) (E3.3)
		Environmental certification (LEED/Ecovadis/CSR) (E3.4)
		Use of conflict minerals (tin, tungsten, tantalum, gold) (E3.5)
		Spill prevention plans (plan/methods of containment for different spills/spill response to different substances) (E3.6)
		Environmental considerations made (Environmental efficiency of operating procedures, use of sustainable materials, Biodegradable/compostable (%), Emissions and waste (per unit of product), Pre/post-consumer recyclable content (%), Recyclable item (% of total), Volume of waste sent to landfill, renewable fuels used, use of ozone depleting substances) (E3.7)
	Pollution Control and Waste Management (E4)	Waste reduction strategies: (1) Can waste be recycled rather than sent to a landfill? 2) Can disposal in landfills or incinerators be minimized? 3) Can unused materials be returned to suppliers? 4) Can equipment packaging be returned to suppliers? 5) Can environmentally preferred products (ones that are easier on the environment) be used?) (E4.1)
		Pollution Control (pollution factors constituted from the supplier production and service processes and product components. Related with air emissions, wastewater, spills noise, soil, odor and solid wastes) (E4.2)

TBL aspect	Criteria	Performance indicators
		Site waste management plan (Including Waste minimization plans such as: (1) Eliminating equipment pieces or connections where possible 2)Modifying or replacing standard equipment pieces, for example, using seal-less pumps 3)Using design practices that provide early detection of losses (e.g., aboveground tanks and piping) 4) capture and recycle to prevent or minimize waste generation 5) carry out 'process stream inventory" to consider streams with potential to generate waste) (E4.3)
	Management of hazardous substances (E5)	Hazardous substances management (requirements facilitating safe handling, use, storage and disposal of hazardous chemicals/materials/substances) (E5.1)
		Hazardous air emissions (CFC's, EtO, MEK, Toluene, etc.) (E5.2)
		Design of products to avoid or reduce use of hazardous products and their manufacturing process (E5.3)
		Regulations on use of hazardous substances (E5.4)
	Life Cycle Assessment (E6)	Life Cycle Analysis (E6.1)
		Life Cycle Costs, Net Life Cycle Costs (E6.2)
	Environmental regulations/Environmental compliance (E7)	Environment related certificates (ISO 14000/ISO 14001/ EMAS/ AS NZS ISO 14001) (E7.1)
		Environmental compliance with environmental laws and regulations (E7.2)
	Environmental Management Systems (EMS) (E8)	Existing environmental management systems (E8.1)
		EMS Program Development, Implementation, and Evaluation (E8.2) - Pollution Prevention and Waste Minimization Programs - Sustainability Programs - Energy Efficiency Programs - Air, Water, and Soil Monitoring - Permit and Consent Coordination - Air Dispersion Modeling - Environmental Impact Assessment - Spill Prevention/Control Countermeasure Planning - Environmental Audit/Assessments - Waste Disposal Planning

TBL aspect	Criteria	Performance indicators
	Energy efficiency (E9)	Reduction in energy consumption (both direct (natural gas, diesel, gasoline) and indirect energy use (for electricity)) (E9.1)
		Use of renewable energy (E9.2)
		Amount of energy and efficiency required for the products manufacture and assembly (amount of energy used per unit of product) (E9.3)
	GHG emissions/Carbon footprint/ Carbon management (E10)	Carbon reduction in project execution, operations and maintenance (E10.1)
		Carbon reduction targets in project execution, operations and maintenance (E10.2)
		Reduction and evaluation of CO2 emissions and CO2 footprint (E10.3)
	Product stewardship (E11)	Design for the environment (E11.1)
	Green competencies (E12)	Availability of clean technologies (E12.1)
		The type of materials making up the supplied component (E12.2)
SOCIAL	**Employment practices (S1)**	Corporate code of conduct (S1.1)
		Employee benefits (such as dialogue with employees, training and education, employment stability, career development, working hours, wages and benefits, security and welfare, privacy) (S1.2)
		Diversity, Equity, and Inclusion (S1.3)
	Health and safety (S2)	Health and safety of employees and community (S2.1)
		Operational facilities are ISO 45001/ OHSAS 18001 certified (S2.2)
		Safety total case incident rate (TCIR) (S2.3)
		Accident prevention and exposure to harmful materials or process or health risks (S2.4)
	Local Community Influence (S3)	Skills enhancement of local workforce (S3.1)
		Community dialogue and engagement (S3.2)
		Investment in local community and community involvement (S3.3)
		Diverse and local suppliers (S3.4)
	Stakeholder's influence (S4)	Stakeholder relations and participation (S4.1)
		Information provision (S4.2)
	Company efforts (S5)	Environmental image of company (S5.1)
		Social responsibility efforts (S5.2)
		Training and programs for employees for green consciousness (S5.3)

	Criteria	Performance indicators
	Discrimination (S6)	Discrimination in employment (age, religion, gender, and other similar factors) (S6.1)
		Racial or sexual discrimination and harassment (S6.2)
	Child/Forced labor and rights (S7)	Measures to prevent or eradicate child or forced labor (S7.1)
	Employee and stakeholder rights (S8)	External stakeholder human rights (e.g., local communities, civil society) (S8.1)
		Rights of indigenous people (S8.2)
	Contribution to society (S9)	Tools and resources to support community building, charity, volunteering (S9.1)

3.4 Chapter 3-Document review conclusion and next steps

The main aim of document review, similar to literature review, was twofold: first, to understand the characteristics of the case EPC company, FCBV (answering SQ1). Second, to develop the conceptual sustainability framework based on case company documents to assess the sustainability level of suppliers/(sub-)contractors (answering SQ2).

The goal of understanding the specific attributes of the case company (FCBV) was to understand their practices and their context in the research study. This involved understanding the project contract strategies (EPCM) used at FCBV, the contract types used (cost reimbursable, lumpsum, unit rate), and the procurement process carried out at FCBV. Understanding the procurement practices at FCBV was important, as within the company procurement is divided into two: Material Management (MM) and Contract Management (CM). Where, MM is involved with the acquiring of materials and equipment from suppliers/vendors, CM is involved with the acquiring of services from (sub-)contractors. Looking at the company perspective is also important as it helps to understand the specific company characteristics and how it relates to the insight gathered from literature.

In order to assess the sustainability level of supplier/(sub-)contractors, the concept of sustainability identified during literature review, the Triple Bottom Line (TBL) concept was used. The TBL concept was also selected as within FCBV, sustainability is also described using the social, environmental and economic dimensions mentioned in the TBL. The case company documents relating to sustainability were then reviewed, to identify sustainability aspects and ambitions within the company. This was classified into sustainability criteria and performance indicators, similar to the literature review process. This ultimately resulted in the development of the conceptual sustainability framework (SF.2, Table 3.1) linked to practice. A total of 12 environmental criteria and 71 performance indicators, 8 social and 36 performance indicators and 7 economic and 42 performance indicators were identified.

From section 2.2.4 and 3.2, the conceptual sustainability frameworks developed from literature review (SF.1, Table 2.1) and document review (SF.2, Table 3.1) are combined and synthesized into a single concise framework (SF.3, as seen in section 3.3, Table 3.2). The combined framework consists of 12 environmental criteria and 33 performance indicators, 9 social and 22 performance indicators and 11 economic criteria and 28 performance indicators. This version of the sustainability framework thus contains a holistic list of sustainability criteria and performance indicators with a base in both literature and practice. Thus, the conceptual framework developed will include the expectations from suppliers/(sub-)contractors regarding sustainability as well as the company ambitions and goals regarding achieving sustainability. Additionally, at this stage, a first validation check was conducted, and it was concluded that majority of the economic criteria and performance indicators identified in the framework were already part of the case company's procurement process. Thus, the focus of the framework will be on the **environmental and social criteria** and their corresponding performance indicators.

In the upcoming chapter (Chapter 4-semi structured interview), the sustainability framework developed in section 3.3, will be further prioritized during the interviews. The goal of prioritization is to gather a holistic opinion on different actor (Client, EPC, supplier/(sub-)contractor) views on the identified performance indicators. The prioritized framework can then be integrated into an EPC company's project procurement practices. This will thus answer SQ4 and identify the performance indicators Client, EPC(Fluor) and Supply Chain professionals consider important to be integrated into the procurement practices in projects. Once the final framework has been developed, the upcoming chapters will address the recommendations on how it can be integrated into the procurement practices of an EPC company.

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PHASE TWO

SEMI-STRUCTURED INTERVIEWS

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CHAPTER 4

SEMI-STRUCTURED INTERVIEWS

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CHAPTER 4: SEMI-STRUCTURED INTERVIEWS

This chapter focusses on explaining the use of semi-structured interviews as the main qualitative research method for gathering and analyzing empirical data for this study. The outcome of this chapter provides the answers for SQ3 and SQ4:

SQ3 What enablers and barriers are encountered by EPC companies in integrating sustainability into their procurement practices?

SQ4 How can the performance indicators be prioritized to add most impact when integrated into procurement?

This chapter is structured as follows: first the preliminary steps taken to select potential interviewees for the semi-structured interviews are discussed (4.1). This involves conducting exploratory interviews and identifying case studies. Section 4.2 goes in depth into how the interviews were conducted, the interviewee selection, the interview protocol, and the data analysis method. Sections 4.3 and 4.4 explores the barriers and enablers encountered by EPC companies in integrating sustainability into procurement (thus answering SQ3). Finally, section 4.5 discusses how the sustainability indicators identified in the conceptual framework (section 3.3, Table 3.2) can be prioritized to add most impact when integrated into project procurement (thus answering SQ4). Finally, the chapter summary and next steps are described (4.6).

4.1 Exploratory Interviews & Case studies

The conducting of exploratory interviews and case studies acts as a precursor to the semi-structured interviews and identifies potentials interviewees to take part in the data gathering process.

Exploratory Interviews

The goal of the exploratory interviews is to reach out to engineering and procurement professionals within Fluor to identify potential projects/case studies that have integrated sustainability in them. Initially the scope is limited to contacting only procurement professionals within Fluor, in order to identify sustainable procurement practices implemented in projects. But due to the limited projects having sustainable procurement practices implemented in them, engineering and project managers within Fluor are also approached, both within and outside the Netherlands. Thus, a total of 10 informal exploratory interviews were conducted (Table 4.1).

Table 4.1: List of exploratory interviews conducted

Cd	Role	Department/Business Line	Location
I1	Material Management Manager	E&C/ES	NL
I2	Project Director	E&C/ES	NL
I3	Corporate Development & Sustainability	-	NL
I4	Supervisor Contract Management	E&C/ES	NL
I5	Director Contract Management	Infrastructure	NL
I6	Sr Project Director	Infrastructure	NL
I7	Assoc Construction Support Specialist	Infrastructure	USA
I8	Project Specialist	ATLS	USA
19	Contract Admin	E&C/ES	NL
I10	Director Material Management	E&C/ES	NL

Results of exploratory interviews

Exploratory interviews were conducted to have unstructured discussions with Fluor professionals to explore the topic of sustainability in projects and procurement further and gain additional contextual data. In addition to that, initial feedback and thoughts on the research topic was also asked during the exploratory interviews. The main goal was to identify projects in which sustainable aspects were integrated into any project phase, but preferably during procurement. Few questions asked included:

"Which projects are you aware of that had sustainability integrated in them in any project phase?",

"How do you think sustainability can be implemented in project execution or procurement?",

"What sustainability aspects were considered in the identified projects?"

"What aspects of sustainable procurement are usually considered in the projects executed?"

The discussions with Fluor professionals from different departments within the Netherlands and internationally, resulted in a list of projects that have integrated sustainability during any project phase. From this list, the projects within the Netherlands and having accessible information were chosen as case studies. This includes both projects in the Energy & Chemicals (E&C)/Process industry (known as Energy Solutions within Fluor), as well as in infrastructure (known as Urban Solutions within Fluor).

Case studies

Through exploratory interviews, a list of projects or case studies that have integrated sustainability in any project aspect or phase are identified. The projects belong to both Energy & Chemicals (E&C/ES) as well as the Infrastructure industry. The rationale for choosing infrastructure projects is that, since the infrastructure industry is further along regarding sustainability in projects, to see what insight could be gained that could be potentially translated into the process industry. This would also address the problem statement (section 1.5) that sustainable procurement has progressed more in the infrastructure industry and help gather more insight into this. The goal of selecting case studies is to identify Fluor, Client and Supply Chain (suppliers/(sub-)contractors) related to these case studies for the interviews. This will provide an opportunity to go more in depth into the sustainability aspects identified in the case studies as well as provide a more concise list of professionals to be interviewed.

A total of 7 case studies (code: CS) within the Netherlands were selected: 5 from the Energy & Chemicals (oil, gas and petrochemical) industry and 2 from the infrastructure industry. An overview of the key characteristics of the identified case studies is mentioned below in Table 4.2.

Table 4.2: Case studies identified

Cd.	Industry	Project Description	Project Stage	Sustainability related aspects identified
CS1	Energy & Chemicals	Construction of a new grassroots chemical plant that produces end product which can be used again as a raw material in order to increase existing production capacity.	Pre-FEED (conceptual design) and FEED	• Bidders were asked to provide a draft sustainability plan. • Bidders asked to participate in in client evaluations related to TfS (together for sustainability) initiative

Cd.	Industry	Project Description	Project Stage	Sustainability related aspects identified
				• Client requirement to have Ecovadis corporate social responsibility (CSR) certificate to be allowed to bid. • In case no certificate, can bid if they will obtain Ecovadis certification/TfS audit in 12 months.
CS2	Energy & Chemicals	Working on exploring and identifying the solution needed to reduce hazardous emissions produced by the production plant during the industrial processes	Phase 1 of FEED study	• The project was sustainable as the focus was on reducing and eliminating emissions created during the industrial processes carried out by the client. • Shortlisted vendors were asked to develop a solution technically suitable for the project and were paid by client for additional effort needed for preparing the quotation
CS3	Energy & Chemicals	A circular economy project for recycling end of life materials to create oil and chemicals which can be used as raw materials again.	FEED studies	• a circular economy project • looking at process equipment alternatives that reduce emissions
CS4	Energy & Chemicals	Developing and expansion of process plant to produce chemical end products	Close-out stage	• Use of sustainability initiatives tracking register, • Light emitting diodes, • Bulk purchases, • Transport over water, • Employee awareness of sustainability activities
CS5	Energy & Chemicals	A recommissioning project of a PPE (Polyphenylene ether) plant	Project completion (final works and turnover)	• This case study was selected due to the availability of client, EPC and supply chain members, who have sustainability ambitions within their organizations.
CS6	Infrastructure	PPP project regarding road construction of a motorway	DBFM (Finished construction in 2021 and currently in operate and maintain phase for 20 years)	• Reduce energy consumption using white asphalt with high visibility lining • Waste management • Solar field installed • Reuse of sheet pile walls • CO2 ladder

Cd.	Industry	Project Description	Project Stage	Sustainability related aspects identified
CS7	Infrastructure	PPP project regarding road construction of a motorway	DBFM (Finished construction in 2018 and currently in operate and maintain phase for 25 years)	• Use of conveyor belts to avoid lorry transport, • Use of improved asphalt to reduce heavy maintenance • Waste management • Considered MEAT aspect for animal crossing in ecoduct • CO2 ladder

4.2 Conducting semi-structured interviews

This section explains the use of semi-structured interviews as a qualitative research method to gather and analyze empirical data for this research study.

4.2.1 Introduction

The previous sections discuss the conceptual sustainability framework developed, and the case studies identified. This section involves gaining more practical insight into the study topic. Therefore, semi-structured interviews were chosen as the method of data collection.

Semi-structured interviews are a commonly used data collection method in qualitative and interpretive research (Balushi, 2018). This method was chosen as it provides the opportunity to gather varying opinions from interviewees as well as go in depth to understand the matter through interviewee interactions (Myers & Newman, 2007; Legard et al., 2003). Semi-structured interviews also provide the possibility to address new topics and issues when they arise during the conversation, thus being able to "explore new paths that emerge during the interview which was not considered earlier" (Gray, 2004). This provides the researcher with the ability to understand the matter discussed further and ask follow-up questions to gain more clarity and prevent loss of relevant information.

The goal of the semi-structured interviews is to understand what is currently happening in the industry regarding sustainable procurement. This included identifying barriers, enablers, current trends, different actor ambitions and requirements and so on (the interview themes addressed are presented in Appendix C.1). Additionally, it also provided the opportunity to gain insight on the level of importance or priority given to each performance indicator identified in the conceptual framework.

4.2.2 Interviewee selection

The selection of interviewees was based on the case studies identified (section 4.1). First, the client, EPC (Fluor) and supply chain (suppliers/(sub-)contractors) actors involved with the case studies are identified. This involves Procurement & Contracts professionals from Fluor, Procurement or Sales professionals from suppliers or (sub-)contractors and Procurement professionals from the client side. This is also based on the logic that Procurement & Contracts (P&C) members from Fluor (EPC company), will interact downstream with the sales or P&C members of the suppliers/(sub-

)contractors, and upstream with the P&C members of the client organization (Figure 4.1). The interviewees were approached via email and meetings scheduled as per their availability.

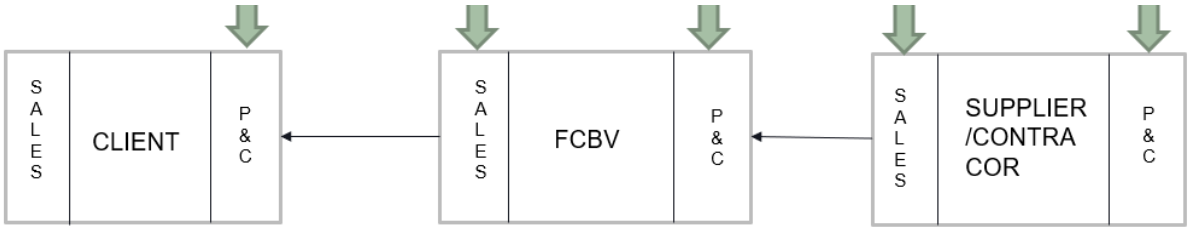

Figure 4.1: Interviewee selection

All actors involved in the project chain is considered as it provides a holistic understanding on the research topic as well as provides different perspectives to the same aspects discussed. In case relevant actors were unavailable (due to holiday season), the next best suited alternative is considered. Table 4.3 shows the interviewees selected, the case studies they were associated with, their roles and years of experience in that role.

A total of **19** interviewees were selected and classified into 4 categories: Client (codes: CL1, CL2, CL3, CL4 & CL5), Fluor (codes: F1, F2, F3, F4, F5, F6, F7 & F8), Supplier (codes: S1 & S2) and (Sub-)Contractor (codes: CO1, CO2, CO3 & CO4). The actors were part of both the Energy & Chemicals (E&C)/Energy Solutions (ES) sector, as well as Infrastructure (Infra). Thus, for each identified case study, the Fluor procurement and contracts people, the client, and the downstream supply chain from whom services, materials and equipment were procured were chosen.

Table 4.3: Overview of selected interviewees

Category	ACTOR (code)	CASE STUDY ASSOCIATED WITH	SECTOR	ROLE	YEARS OF EXPERIENCE IN THIS ROLE
EPC Company (Fluor)	F1	-	ES	Sales & Business Development	9
	F2	CS6	Infra	Procurement & Contracts	10+
	F3	CS2	ES	Functional lead-Material Management	11
	F4	CS4	ES	Manager-Material Management	14
	F5	CS7	Infra	Contract Management	6
	F6	CS1	ES	Procurement Manager	17
	F7	CS1	ES	Contract Management	6
	F8	CS3	ES	Sr Buyer Procurement	10+
Client	CL1	CS3	E&C	Engineering Manager	4
	CL2	-	Infra	Contract Manager	2
	CL3	CS5	E&C	Sustainability & Energy engineer	5
	CL4	CS6	Infra	Sustainability in DBFM projects	3+
	CL5	CS6	Infra	Contracts Manager DBFM projects	5
Contractor	CO1	CS5	E&C	Project Manager	10
	CO2	CS5	E&C	SHEQ Manager	9
	CO3	CS5	E&C	Procurement Manager	1
	C04	CS6	Infra	Co-owner	20+
Supplier	S1	CS4	E&C	Project Manager	8
	S2	-	E&C	Business Developer	1

4.2.3 Interview Protocol

An interview protocol consists of the script the interviewer says before the interview, the questions asked during the interview and the closing remarks to conclude the interview. The interview protocol is meant to act as a guide to the interviewer throughout the interview process.

Prior to the interview date, the interviewees were provided with an informed consent form, to ensure that the purpose and method of data gathering and its use in the research was clear. Additionally, the interview themes addressed during the interviews were also shared to give interviewees an idea about the topics that would be discussed. Before the start of the interview, the purpose of the interview and a quick recap on the main goals of the study were addressed. To ensure confidentiality and interviewee privacy, the interviewee was made aware that the meeting was being recorded (audio/video) and verbal permission was also asked.

At the start of the interview, the interviewees were asked introductory questions such as their role in the company, the years worked in that role and their role within procurement and contracts. The terminology used in the interview was also discussed to ensure both the interviewer and the interviewee were on the same page. The introduction questions were followed by the main data gathering questions, focusing on 6 themes. The themes and the interview questions associated to each theme, are described in detail in Appendix C.1.

The interviews were planned to have a flexible duration of 60-80 minutes. The purpose of keeping the interview duration flexible was to ensure a buffer period to account for the difference in the depth of the answers provided by the interviewees.

4.2.4 Data analysis

Data analysis is used to identify the emergent themes and views discussed during the semi-structured interviews. Marshall & Rossman (1995) mention that “data analysis is the process of bringing order, structure and meaning to the mass of collected data”. In order to structure the data and give it meaning for further analysis, the latest version of ATLAS.ti was used. ATLAS.ti is a qualitative data analysis software tool used to organize data by assigning codes to the transcribes interviews using open coding based on the emergent themes (Miles & Huberman, 1994). The coding approach was both inductive and deductive. In the inductive approach, it is more bottom-up where the researcher reads through the data and allows codes to emerge, while deductive is more top-down where predetermined codes are applied to the data (Bingham & Witkowsky, 2022).

The codes were assigned to the different views regarding sustainability in procurement of the actors interviewed, the identified enablers and barriers, the suggestions by the actors on improving sustainability in practice, the currents trends observed in the industry and so on. A total of **145** main codes were generated at the end of this process. For example, Interviewee F1 mentioned “instead of only having a top-down approach, you still need to give the openness to other actors to pitch their idea” and was assigned the code ‘*bottom-up approach’*. Interviewee S2 mentioned “we need to collaborate as a supplier with EPCs to share our experiences to optimize our approach to sustainability”, and Interviewee CO4 mentioned “it’s important in a project that we understand we need each other and that we are on the same level. So, we need to connect with them”. Since both the statements described the need for collaboration between the parties involved, both were given the code *‘collaboration’*. An example of the codes developed in ATLAS.ti can be seen in Figure 4.2.

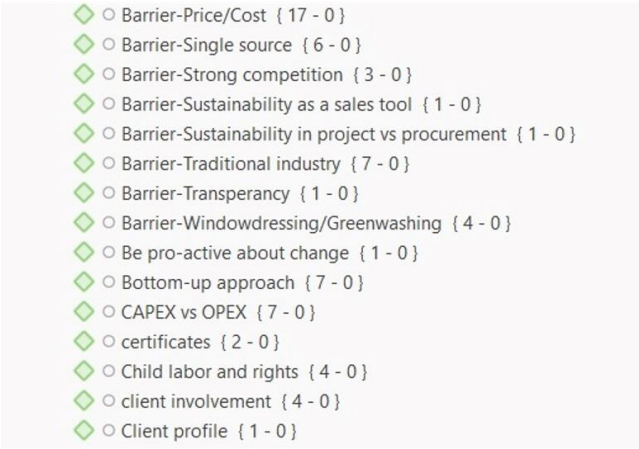

Figure 4.2: Snapshot of main codes developed in ATLAS.ti

The analysis of the transcripts and the codes developed using ATLAS.ti mainly provided three important findings:

- Enablers and barriers to integrating sustainability into procurement
- Prioritization of the indicators in the sustainability framework and reasoning
- Client, EPC(Fluor) and Supply Chain (suppliers/(sub-)contractors) suggestion on integrating sustainability into procurement

The interview transcripts are included in Appendix C.2. Since the main findings were obtained from themes 4 and 6, they will be explored in detail in the transcripts. The above-mentioned findings will be discussed in further detail in the upcoming sections.

4.3 Enablers to integrating sustainability into procurement

This section discusses one of the major findings from the data analysis: the enablers to integrating sustainability into procurement within companies, thus partly answering SQ3.

4.3.1 Identifying the enablers to integrating sustainability into procurement

The enablers to integrating sustainability into procurement include those factors that support the effective and efficient introduction, implementation and acceptance of sustainability in a company's procurement practice. Through data analysis and subsequent coding in ATLAS.ti the following enablers to sustainable procurement were identified:

[1] Price/Cost as an enabler

An enabler to sustainability considerations made during procurement commonly addressed by interviewees is the price or cost. Majority of the interviewees mention that the cost of a sustainable supplier/(sub-)contractor plays an important role in deciding whether to choose a sustainable supply chain actor over another. If a sustainable supply chain actor is competitively priced, EPC companies and clients are more open to selecting them. Also, if they can show how they can reduce the operation costs (OPEX), they are still desirable to EPCs and clients. Interviewee F1 mentioned "it just comes down to money", while Interviewee F3 mentioned "I think we are still at a moment where price matters a

lot". Interviewee CL1 mentioned "at the end we are going to go with a/b supplier or (sub-) contractor because those are cheaper than c/d".

[2] Role of Client/Owner as an enabler

The client also plays an enabling role within EPC companies as the final decision-making power lies with the client. If you have a client/owner focused on integrating sustainability into their project procurement, EPC companies will be forced to consider looking at selecting a more sustainable supplier/(sub-)contractor. Interviewee F1 mentioned "big players in the market will change the game, they will change the market and they will start pushing for these kinds of criteria's". Interviewee F2 mentioned "it will depend on whether or not these private clients want to promote themselves as sustainable and by doing so demonstrate that they only work with contractors and subcontractors which can show a certain sustainability performance". Interviewee F6 mentioned "especially in the type of contracts that we mostly do, we are buying for and on behalf of the client. So, we don't determine the requirements, the clients do. If they want to go sustainable ten that's the name of the game".

[3] Mindset/Culture as a driver

Mindset is used to describe the characteristics of people, while culture is more focused on the organization's perspective. Both mindset of the people and culture within the organization are enablers to integrating sustainability into procurement. They help push the topic of sustainability by creating a general culture or mindset within the organization and its employees towards thinking sustainably. Interviewee F7 mentioned "newer clients are a lot more open minded". Interviewee CL4 mentioned "the whole mindset is turning about how we use energy, how we use material". Interviewee CL1 mentioned "it will also benefit EPCs if they start doing it from their own mindset. And not because the clients tell them but thinking proactively to figure out how companies work and how they can improve as well." Interviewee F3 mentioned "one of the enablers is the kind of culture or vision of the companies".

[4] Governments/Legislation

Governments have the power to steer and enforce sustainability in procurement by developing legislations or laws that require companies to look at sustainability during their sourcing and purchasing activities. Interviewee CO1 mentioned "the government or European laws drive companies in the direction that they are required to absolutely do something", while Interviewee F3 mentioned "the governments can help with their subsidies."

[5] Collaboration and continuous dialogue

Collaboration plays an important role in enabling sustainable procurement as it provides the opportunity for companies to share what they learn and facilitate discussions that will push the topic further. Integrating sustainability should also not be an 'one & done' process, where it is only considered once and not revisited. A continuous dialogue is required between all involved parties to ensure performance meets targets and opportunities for improvement are addressed. Interviewee S2 mentioned "experience exchange has started where we can collaborate as a supplier with an EPC to share experiences and optimize our approach to sustainability". Interviewee CL3 mentioned "integrating sustainability is more of a continuous dialogue during the project where you agree upon whether its sufficient or not".

[6] Transparency

Companies also need to be transparent on how they are tackling sustainability within their organization and their practices. This also gives stakeholders an opportunity to hold companies accountable for their practices, with regards to their sustainability actions. This will drive companies to think more sustainably during their procurement process. Interviewee S2 mentioned "companies need to justify and declare or show how they are keeping the sustainability".

[7] Long term vision/strategy

Long term vision is also considered an enabler to integrating sustainability into procurement. So not only looking at the immediate costs of sustainability, but also looking at the long term benefits it can bring during project execution, operations, and maintenance. Interviewee CL1 mentioned "it's not something that you just do for one project, but something on how you will approach projects over the long haul". Interviewee CO4 mentioned "earlier people used to look at what is happening short term, now people are looking for long term".

[8] Market and Stakeholder requirements

The requirements of the market and stakeholders also play an important role in enabling sustainability in procurement. In order to maintain a competitive position in the market as well as have public support, companies need to think more sustainably. Interviewee F1 mentioned "what's driving our clients is that they want to remain market leader, so they need to invest in new processes and increase their capacities and they can only do it in a sustainable way". Interviewee F5 mentioned "companies will look at sustainability because it better positions them, the market demands that and so do the shareholders which is why it is being translated into procurement."

[9] Current energy/gas prices

Due to the current increase in the price of gas and energy, major clients in the Energy & Chemicals industry will be forced to look for more sustainable alternatives during project execution. This will also flow-down to their EPC contractors and supply chain. Interviewee F1 mentioned "especially with the current increase in the gas and energy prices, it's quite an easy driver. With the high energy prices, it's quite easy to make the evaluation because when you use 10/20% more energy, it's much more expensive". Interviewee CL1 mentioned "the energy prices are so high that the OPEX has really popped up and we are actively thinking about changing the perimeter to make sure we have equipment with less consumption in place".

[10] Creating awareness

Creating awareness among the different actors involved in the project chain: clients, EPCs and supply chain, is also very important to enable sustainability in procurement. This can be awareness regarding the companies environmental and social impact, knowledge about sustainable procurement and how it could be implemented in projects. It can be done through workshops, awareness trainings for purchasing employees and supply chain actors and open platforms to discuss the topic of sustainable procurement. Interviewee F3 mentioned "I think EPCs like us have to contribute to create awareness regarding sustainability, so that suppliers think is important to do that because that will also open their doors to new businesses".

[11] Setting requirements for sustainability

Within the procurement process in companies, requirements need to be set for sustainability to ensure it is considered during selection or evaluation of supply chain actors. Interviewee F2 mentioned

"if there are specific criteria, it will be in the bid evaluations and will have a higher importance in selecting the contractors". Interviewee CL2 mentioned "setting hard requirements is one of the big enablers that clients can do."

[12] Long term relationships

Looking at having long term relations with suppliers and contractors is another enabler to ensuring sustainability is considered within the supply chain. Having long term relationships with the supply chain ensures that they look at more sustainable options even if more expensive as it would be paid pack to them during the duration of the project or give them an advantage in other projects. Interviewee F6 mentioned "if you have ongoing business with a certain supplier, it's easier to set sustainability requirements in place."

[13] Company initiative

EPC companies also need to give importance to the topic of sustainability within procurement. even if it is not set as hard requirements (as that would depend on the client), EPCs should still ensure that sustainability is discussed as an added value to procurement, this can be done through company initiatives to create that environment within the procurement organization. Interviewee F7 mentioned "if the EPC company says sustainability is important to look at in evaluating contractors, then I will look into it."

[14] Price advantage

If suppliers/(sub-)contractors are given a price advantage in bids, that could also act as an enabler to integrating sustainability into the supply chain, as they would consider looking at more sustainable options while still remaining competitively priced. This can be in terms of bonuses or providing a discount in their bids, etc. Interviewee F3 mentioned "you can look at a bonus malus kind of thing. Giving them a bit of an advantage the more they are engaged in the sustainability aspects."

Table 4.4 shows the summary of the enablers identified by interviewees (per organizational role) during the semi-structured interviews.

Table 4.4: Summary of the enablers identified during semi-structured interview

	Enablers	CLIENT/OWNER					EPC COMPANY (Fluor)								(SUB-) CONTRACTORS				SUPPLIERS	
		CL1	CL2	CL3	CL4	CL5	F1	F2	F3	F4	F5	F6	F7	F8	CO1	CO2	CO3	CO4	S1	S2
1	**Price/Cost as an enabler**	✓					✓	✓	✓	✓		✓	✓	✓		✓	✓	✓	✓	
2	**Role of Client/Owner as an enabler**		✓	✓			✓	✓	✓		✓	✓	✓	✓	✓	✓				
3	**Mindset/Culture as a driver**	✓			✓	✓			✓		✓		✓	✓					✓	
4	**Governments/Legislation**		✓					✓	✓				✓		✓	✓	✓			✓
5	**Collaboration & continuous dialogue**			✓			✓		✓		✓					✓		✓		✓
6	**Transparency**		✓	✓							✓									✓
7	**Long term vision/strategy**	✓			✓													✓		
8	**Market & Stakeholder requirements**						✓	✓			✓									
9	**Current energy/gas prices**	✓					✓													
10	**Creating awareness**								✓							✓				
11	**Setting requirements for sustainability**		✓					✓												
12	**Long term relationships**		✓									✓								
13	**Company initiative**												✓							
14	**Price Advantage**								✓											

4.3.2 Conclusions drawn from identified enablers

A total of 14 enablers were identified from the interviews (summarized in Figure 4.3). Among the enablers identified, price/cost and the role of the client/owner were identified as major enablers to the integration of sustainability into procurement. This is mainly due to the high influence clients have in decision making in projects executed by EPC companies, as well as the preference in the E&C industry to choose a cheaper supplier/(sub-)contractor.

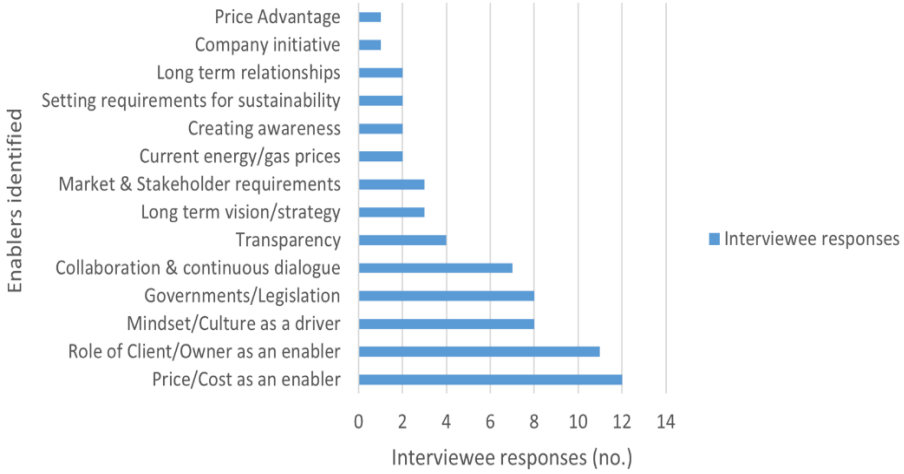

Figure 4.3 Enablers identified from interviewee responses

It was also observed that among **Clients/Owners**, mindset of the people or culture of the company was identified as the most important enabler to integrated sustainability into procurement (mentioned by 3/5 interviewees). This was followed by the role of the client, transparency and long-term vision and strategy (summarized in Figure 4.4). This is logical as clients look at the bigger picture and more organizational influences in promoting sustainability during procurement.

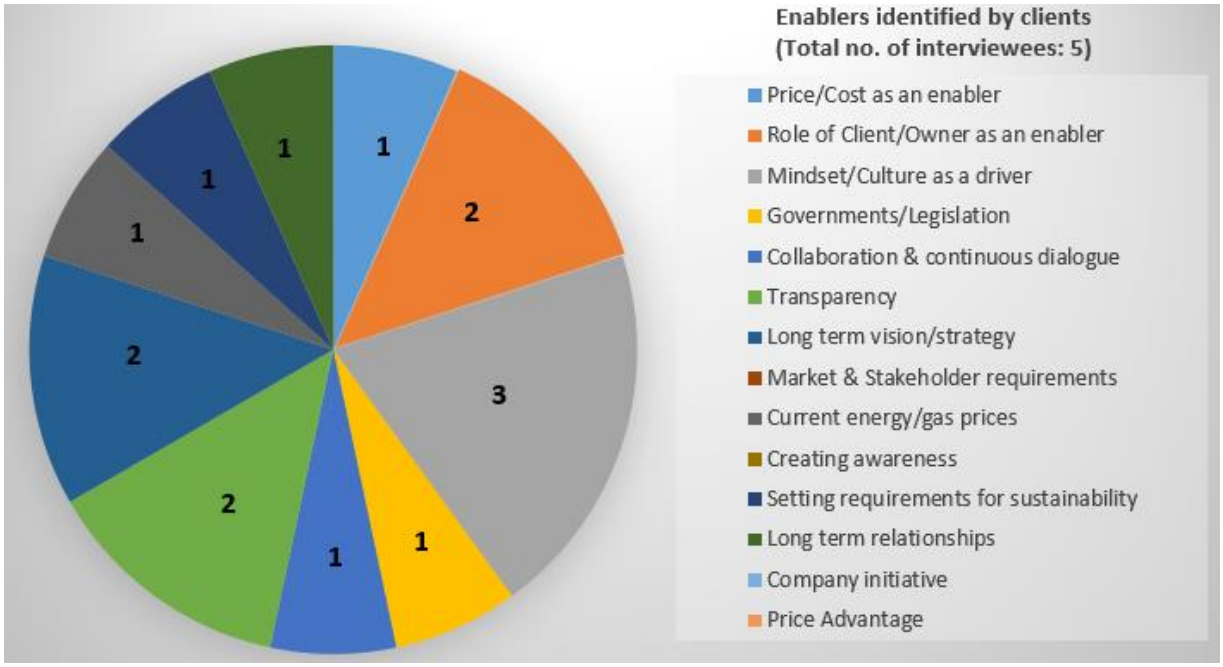

Figure 4.4 Frequency of enablers identified by clients

Among **EPC company (Fluor),** price/cost (mentioned by 7/8 interviewees) and the role of the client/owner (mentioned by 7/8 interviewees) were identified as the most important enablers

(summarized in Figure 4.5). This is also understandable as EPC companies need to adhere to client and budget requirements during the execution of a project. Also, because of their central role in the project chain, connecting client and supply chain actors, the importance given to other enablers is also justified.

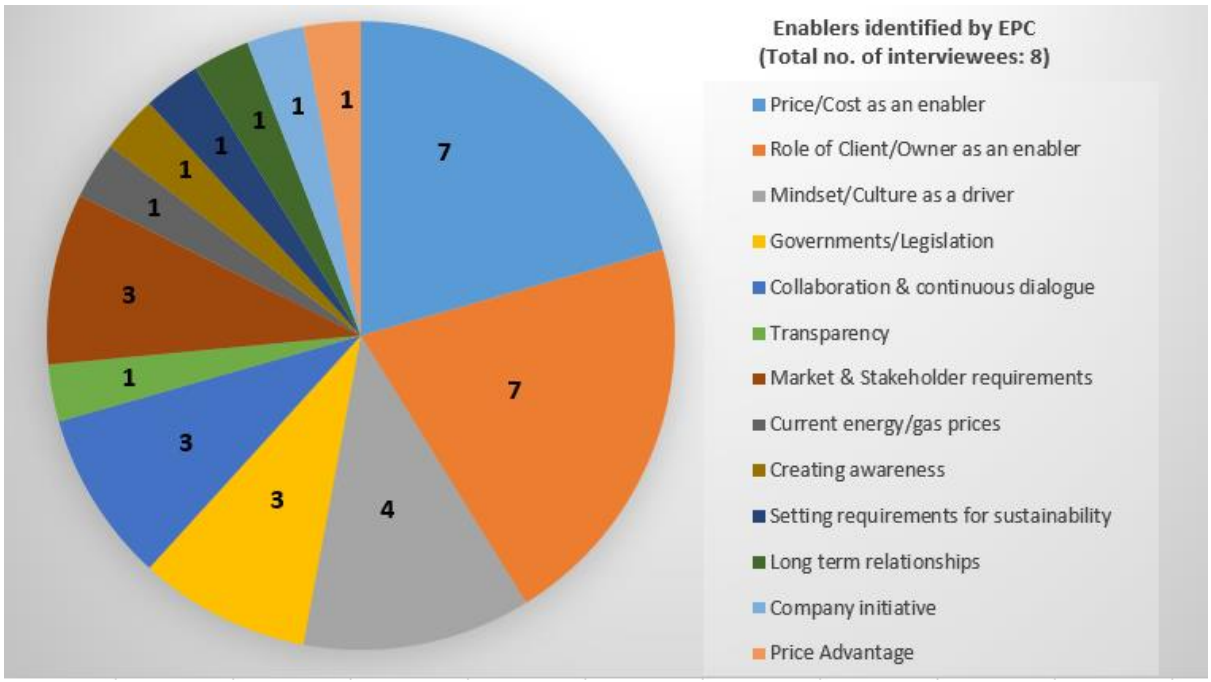

Figure 4.5 Frequency of enablers identified by EPC (Fluor)

Among supply chain actors, **(sub-) contractors** mentioned the importance of price/cost (mentioned by 3/4 interviewees), governmental legislations (mentioned by 3/4 interviewees), role of the client (mentioned by 2/4 interviewees) and the need for collaboration and continuous dialogue (mentioned by 2/4 interviewees) as enablers (summarized in Figure 4.6). Based on their position in the project chain, it is expected that these enablers have priority as they significantly influence how (sub-) contractors can integrate sustainability in their own company practices as well as, during procurement of external vendors.

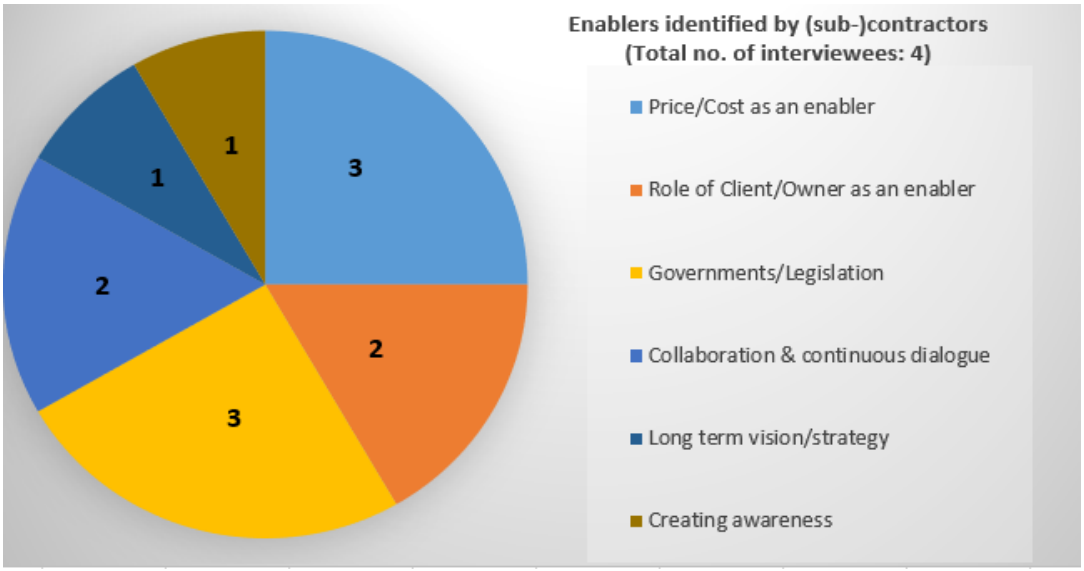

Figure 4.6 Frequency of enablers identified by (sub-) contractors

Among **suppliers**, main enablers identified included price/cost (mentioned by 1/2 interviewees), mindset of people or culture of the company (mentioned by 1/2 interviewees), governmental legislation (mentioned by 1/2 interviewees), collaboration and continuous dialogue (mentioned by 1/2 interviewees), and transparency (mentioned by 1/2 interviewees). Enablers identified are summarized in Figure 4.7. This follows the same reasoning as with (sub-)contractors, as these factors play a strong role in enabling suppliers to look at sustainability within their organization and practices.

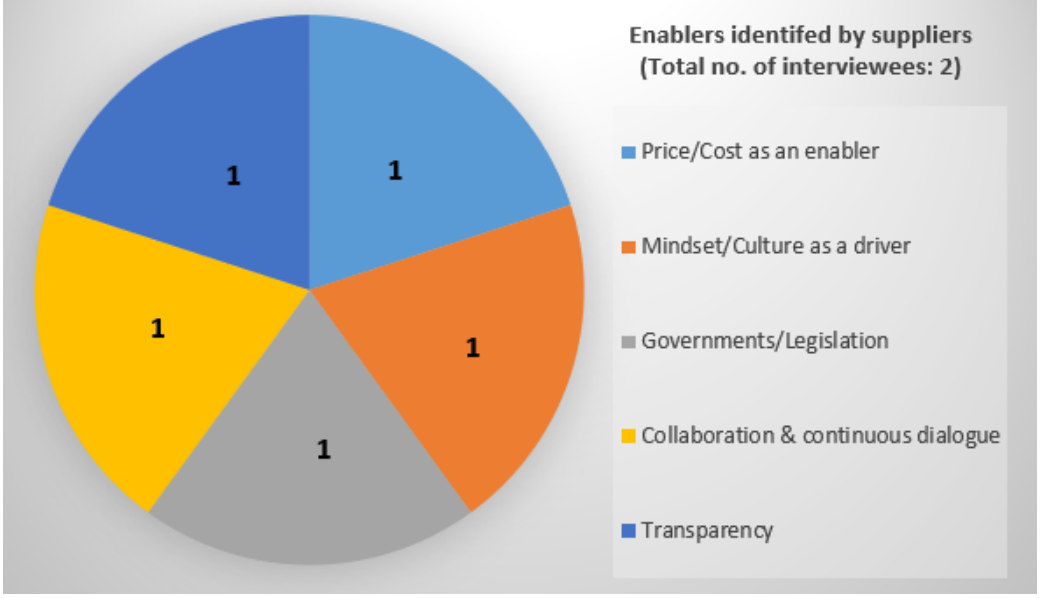

Figure 4.7 Frequency of enablers identified by suppliers

4.4 Barriers to integrating sustainability into procurement

This section discusses one of the major findings from the data analysis: the barriers to integrating sustainability into procurement within companies, thus adding to section 4.3 and ultimately answering SQ3.

4.4.1 Identifying the barriers to integrating sustainability into procurement

The barriers to integrating sustainability into procurement can be understood as anything that could potentially hinder companies from adopting and implementing sustainability into their procurement practices. Through data analysis and subsequent coding in ATLAS.ti, the following barriers to sustainable procurement were identified:

[1] High price/cost

High price/cost can act as a barrier to integrating sustainability into procurement. If the bids provided by suppliers/(sub-)contractors are more expensive than their competition or not within the budget, it can prevent them from being awarded the works. This also leads to lesser flexibility in selecting suppliers/(sub-)contractors. Interviewee F1 mentioned “everybody’s looking at each other, and if they don’t do anything I also do nothing, because when I do something, my product gets more expensive, and I lose the competition. We are all driven by money again”. Interviewee CL1 mentioned “we can’t afford to be very picky with the vendors we need to select.” Interviewee F3 mentioned “we are still at moment where price matters a lot.” Interviewee S2 mentioned “the job of procurement is to obtain supplies at the lowest price or the lowest option. Sometimes sustainable tools and equipment are not necessarily cheap.”

[2] Role of Client/Owner as a barrier

Clients can also act as a barrier to implementing sustainability in project procurement. this is because in private EPC companies, the final decision-making power is with the client. So, if the client does not wish to focus on sustainability, then there is less room to maneuver for EPC companies to look at sustainability within their procurement. Interviewee F2 mentioned "because it takes so much time to see whether or not to have met such criteria for the whole project, it becomes also less important for the client as other changes from the client side are added and focus on sustainability becomes quite difficult." Interviewee CO2 mentioned "my experience is that the focus from the client to sustainability is very low."

[3] Traditional Industry

The oil, gas and petrochemical industry is quite a traditional and conventional market and has been functioning in a certain way for several years. The reluctance within the industry to look at other sustainable alternatives or move away from traditional requirements and methods act as a barrier to integrating sustainability into procurement. Interviewee CL1 mentioned "the industry is very traditional. What we are doing, its traditional market where there's a certain way of doing things, it's not the most dynamic market". Interviewee F7 mentioned "the traditional oil and gas guys will come to us and say, I want you to build this at the lowest cost possible."

[4] Mindset

The mindset of the actors involved in the project chain also plays an important role in determining how sustainability can be integrated into procurement. If clients/EPCs/Supply chain actors don't acknowledge the value of sustainable alternatives and want to execute projects in the traditional way, sustainable procurement becomes difficult. Interviewee CL1 mentioned "that mindset is obviously not there." Interviewee CO1 mentioned "these materials if they satisfy the requirements of the law and the specifications of the plan. We don't care where it comes from." Interviewee S2 mentioned "clients are like 'it works, why should I change it?'. So, they are very reluctant to change."

[5] Changing project drivers

Projects face many complexities, which means that the project drivers also have the potential to keep changing during the project duration. In that case, requirements such as delivering the project on time and budget, getting materials delivered on time, having sufficient labour, etc. takes priority over the focus to be given to sustainability. Interviewee F7 mentioned "depending on the project, project drivers can change." Interviewee F6 mentioned "the individual project manager has a budget which he has to accomplish and achieve a certain profit. When that gets under pressure, a lot of topis disappear including sustainability."

[6] Single/Sole source

Within the Energy &Chemicals industry, many equipment and material are single/sole source. This means that due to specific and unique requirements applicable to each individual project, procurement teams either consciously awards work to one supplier even though there are other who can provide the same supply (single source), or only one supplier is capable of providing the required product/service (sole source). This also means that a lot of the major equipment/machinery used cannot be re-used or repurposed or refurbished. Interviewee CL1 mentioned "with the vendors, especially where we are currently, we don't have that many options anymore. We are pretty much single source." Interviewee F5 mentioned "we are in a specialized business with the energy solutions market, you are busying specific materials and equipment which is not something you can just have

an alternative for and buy locally. There are maybe two or three vendors in the world who do that stuff."

[7] Generic requirements

Currently in the E&C industry, requirements for sustainability are more a 'good to have' rather than a strict requirement. This acts as a barrier towards sustainable procurement as actors are not motivated to include sustainability in their process and procurement practices. Interviewee F2 mentioned "there are some general criteria mentioned in our own contract templates. But those were very generic". Interviewee S1 mentioned "there is not a real request for such sustainability requirements, so it's not mandatory to invest in them."

[8] Window-dressing/Greenwashing

Sometimes organization portray themselves as a lot more sustainable than they actually are. There are many ambitions and goals at the higher levels of the organizations, but implementation in projects is still based on the traditional constraints of time, cost and quality. Interviewee CL2 mentioned "on all these sustainability requirements you will see some window-dressing. Up to 80/90% they try to keep to them, so until a point of no complaint, especially since sustainability is a new topic to them." Interviewee F4 says "I think when you get a project its always at the forefront saying you are sustainable, we want to do this, want to do that, be the best. But a lot is sometimes showing face. In reality that's not what's happening".

[9] Strong competition

Within the industry, there is very strong competition between the different bidding parties to secure the works. This means that unless sustainability is set as a requirement by the client in the tender, it is rarely given a high priority. This is because considering sustainability will cost more ultimately making them more expensive than their competition and they will lose the bid. Interviewee F2 mentioned "because of the very strong competition in the contracting land, most EPC companies only follow the guidelines of the tender if no sustainability goals are there. Because it will cost them more to invest in sustainability and they can be skipped from winning the contract."

[10] Convenience

Since the transition towards sustainability within the industry is still at its initial stages, considering sustainability in procurement is quite difficult due to limited options available. Interviewee CO1 mentioned "clients and EPCs need to see a convenience to look at sustainability. Convenience is not only economical but also convenience in production, in the way to sell the product. Maybe selling a green product is faster than a normal one, then it will be considered."

[11] Lack of knowledge

Within the E&C industry, there is a lack of knowledge within the procurement team on how sustainability can be considered during the procurement process and what can be asked to suppliers/(sub-)contractors. This is due to lack of prior experience and awareness regarding what could be done to stimulate sustainability from the supply chain. Interviewee CO1 mentioned "everything can be done. But what is missing is the knowledge of what to ask suppliers to be sustainable or not." Interviewee F8 mentioned "my problem is that I wouldn't know how to define sustainability. What do we want from suppliers? Is it a question or a certificate?"

[12] Difficulty translating sustainability into evaluation criteria

Currently there are no widely accepted standards or measurement tools available in the market to measure the sustainability aspects of supply chain actors. This in addition to lack of clear guidelines on how sustainability can be evaluated in bids makes evaluating sustainability a challenge. Interviewee F5 mentioned "I have experienced that it is tricky sometimes to give contractors enough credit for their sustainability efforts and have that translated into the evaluation of a certain contract." Interviewee S1 mentioned "there needs to be some kind of measurement tool or certificate which proves what you say is actually done."

[13] Ambitions regarding sustainability in procurement

Even though companies recognize the important of sustainability and its potential benefits, it is not often translated into tangible ambitions that need to be achieved. Unless companies have such ambitions regarding sustainability in procurement, implementation remains a choice rather than a requirement. Interviewee F5 mentioned "the main challenge is how ambitious we are with setting up that strategy and incorporating sustainability into our procurement practices."

[14] Sustainability in project vs procurement

The E&C industry is currently executing several projects in the energy transition, green hydrogen, circular economy, and similar sectors. This means that the sustainability impact of the project itself is quite higher than the potential advantage of selecting a sustainable supplier. Thus, many clients need to make the tradeoff between either executing the project with the available supply chain actors or delay the project and the impact the whole project can have by waiting to select a more sustainable supply chain actor. Interviewee CL1 mentioned "in that sense we can't afford to be picky when it comes to selecting sustainability in vendors. The project itself makes sure we have reached the targets we want to achieve."

[15] Lack of governmental requirements

Within the E&C industry, there are not yet strict governmental requirements, legislations or policies to ensure organizations look at sustainability in procurement. This is different from the infrastructure industry where governmental regulations make it mandatory that you consider the 'economisch meest voordelige inchrijving (EMVI)' or 'beste prijs kwaliteitverhouding (BPKV)' criteria while selecting a supplier or (sub-)contractor. Interviewee CO1 mentioned "the governments are not requiring any feedback on sustainability."

[16] Silos within the organization

Silos within organization indicate independent departments that have little to no interaction with the other departments. This kind of system reduces efficiency during operations, reduces the information being shared among different departments and leads to a lack of inter departmental discussions on how sustainability can be best integrated into the project. Interviewee F1 mentioned "the issue with our clients is that they have a project silo, a HSE silo and they are not connected. They each get a budget and they have to do the project. So not much motivation for sustainability."

[17] Sustainability as a sales tool

Companies often tend to use the topic of sustainability to showcase how green they are, the ambitions they have, the goals they wish to achieve and so on. But discussions on how it can be effectively implemented in projects is still unclear. Interviewee F8 mentioned "I think sustainability is still at a level of a sales tool at the moment, it's not yet really an integrated approach for most sellers."

[18] Lack of transparency

Clients and EPC companies evaluating suppliers/(sub-)contractors don't often disclose their evaluation methods. If there was more transparency on how the bids were being evaluated, supply chain actors would be more inclined to implement sustainability in their practices as they can see the added benefit of it. Also having a partly open-book policy also creates an understanding that the added costs are due to the additional price of sustainability and not due to an increased profit margin. But as long as companies are not transparent, sustainability implementation remains a challenge. Interviewee F5 mentioned "transparency is a major issue. There should be more transparency towards how they evaluate proposals."

[19] Lack of discussion

Discussions between the different actors involved in the project chain are crucial in understanding the different capabilities and ambitions regarding sustainability into the project. Lack of communication and discussion leads to sustainability capabilities, efforts and ambitions going unnoticed and unrecognized, thus slowing down sustainability integration in project procurement. Interviewee CL2 mentioned "the con is that there is not a lot of contact or a lot of options to discuss together what is the best solution and then maybe change the plan towards a more sustainable and better way."

Table 4.5 shows the summary of the barriers identified by interviewees during the semi-structured interviews

Table 4.5: Summary of the barriers identified from semi-structured interviews

	Barriers	CLIENT/OWNER					EPC COMPANY (Fluor)								(SUB-) CONTRACTORS				SUPPLIERS	
		CL1	CL2	CL3	CL4	CL5	F1	F2	F3	F4	F5	F6	F7	F8	CO1	CO2	CO3	CO4	S1	S2
1	**High price/cost**	✓			✓	✓	✓		✓	✓				✓	✓	✓	✓	✓	✓	✓
2	**Role of Client/Owner as a barrier**			✓				✓	✓	✓		✓	✓	✓	✓	✓	✓			✓
3	**Traditional industry**	✓	✓										✓				✓	✓		
4	**Mindset**	✓	✓												✓		✓			✓
5	**Changing project drivers**											✓	✓	✓			✓		✓	
6	**Single/Sole source**	✓									✓			✓			✓			
7	**Generic requirements**							✓		✓									✓	
8	**Window-dressing/Greenwashing**		✓							✓							✓			
9	**Strong competition**						✓	✓										✓		
10	**Convenience**														✓			✓		
11	**Lack of knowledge**													✓	✓					
12	**Difficulty translating sustainability into evaluation criteria**										✓								✓	
13	**Ambitions regarding sustainability in procurement**		✓								✓									
14	**Sustainability in project vs procurement**	✓											✓							
15	**Lack of governmental requirements**														✓					
16	**Silos within the organization**						✓													
17	**Sustainability as a sales tool**													✓						
18	**Lack of transparency**										✓									
19	**Lack of discussion**		✓																	

4.4.2 Conclusions drawn from barriers identified

A total of 19 barriers were identified from the interviews (summarized in Figure 4.8). Among the barriers identified, high price/cost and the role of client/owner as a barrier were most mentioned by interviewees. This is because, similar to the enablers, the integration of sustainable procurement in EPC companies depends on the requirements put forth by clients, as well as the cost of procuring sustainably or selecting a sustainable supply chain actor. The other important barriers identified were the E&C industry being traditional, mindset of the people and changing project drivers.

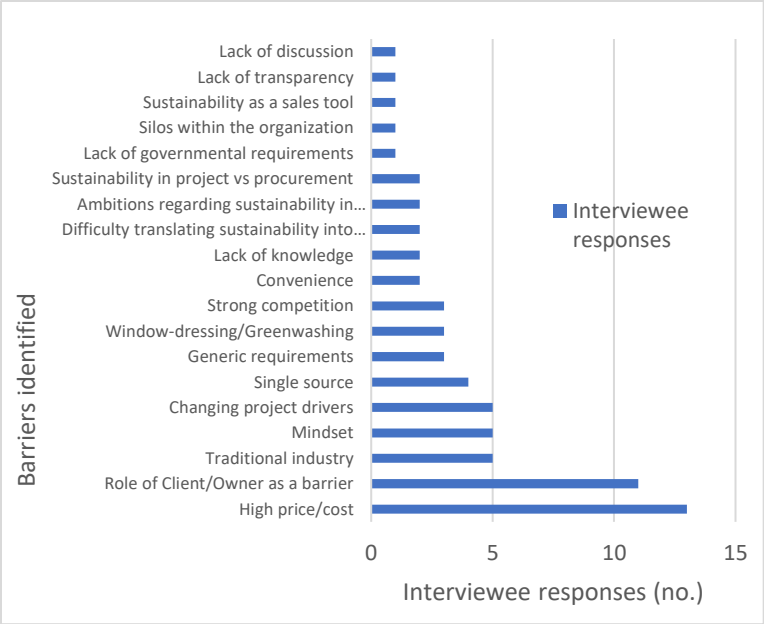

Figure 4.8 Barriers identified from interviewee responses

It was also observed that among **Clients/Owners**, high price/cost was identified as the most important barrier to integrating sustainability into procurement (mentioned by 3/5 interviewees). This was followed by the barrier of E&C being a traditional industry (mentioned by 2/5 interviewees), and the mindset of the people (mentioned by 2/5 interviewees), as summarized in Figure 4.9. This is expected as clients look at completing the project within the budget and due to the traditional industry in which they work, sustainability is not yet given priority during procurement.

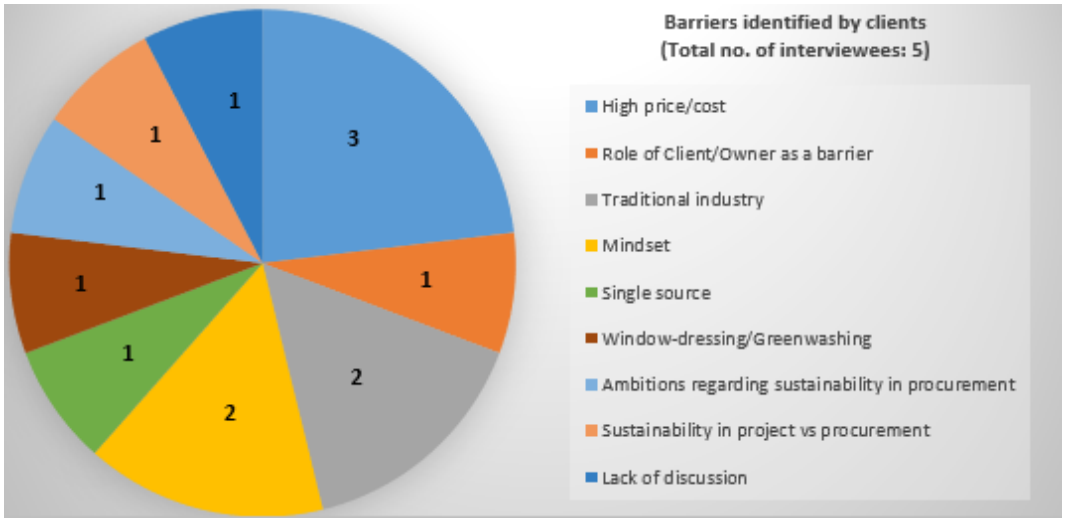

Figure 4.9 Frequency of barriers identified by clients

Among **EPC company (Fluor),** the client is identified as the biggest barrier (mentioned by 6/8 interviewees), as summarized in Figure 4.10. This is also understandable as EPC companies like FCBV work 'for and on behalf' of the client. Thus, client requirements or constraints play a major role. If the client puts forth requirements regarding sustainability in procurement, it will be implemented by EPC companies, as well as asked from supply chain. This is followed by the barriers of high price/cost (mentioned by 4/8 interviewees)and changing project drivers (mentioned by 3/8 interviewees). Their central role in the project chain is also why more barriers are identified within EPCs.

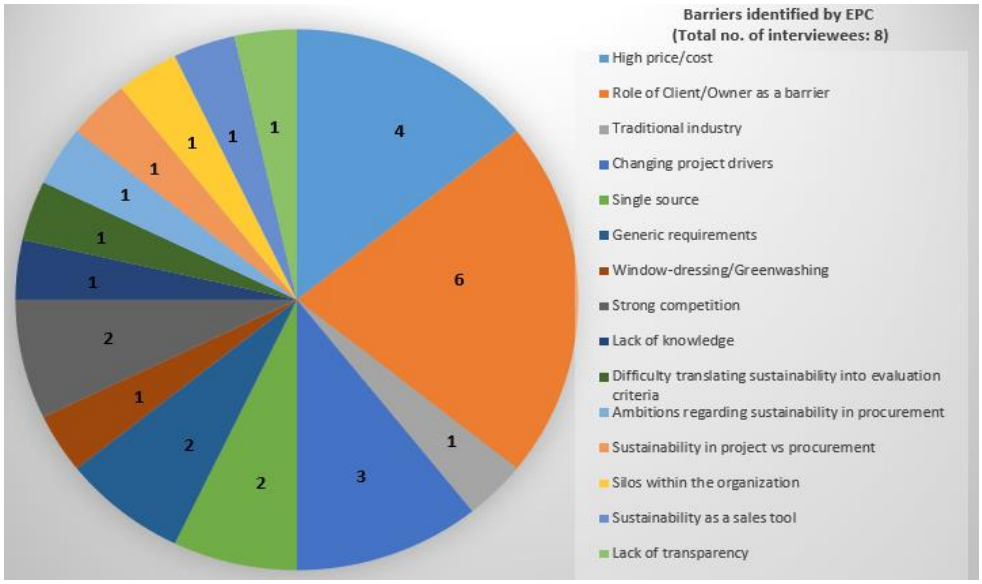

Figure 4.10 Frequency of barriers identified by EPC (Fluor)

Among supply chain actors, **(sub-) contractors** mentioned high price/cost as the major barrier to integrating sustainability into procurement (mentioned by 4/4 interviewees), as summarized in Figure 4.11. This is because within procurement, the goal is to select the cheapest bid available unless specific requirements are in place regarding sustainability. Other main barriers identified include the role of the client, traditional industry, and mindset of the people.

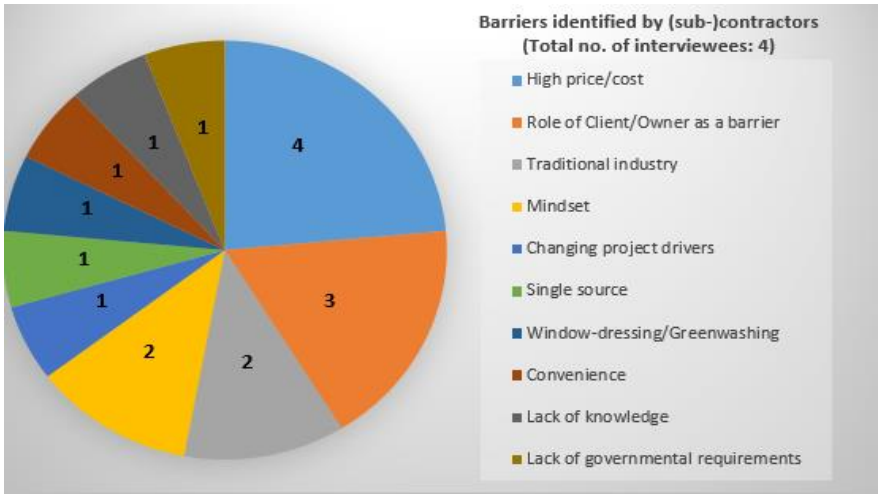

Figure 4.11 Frequency of barriers identified by (sub-)contractors

Among **suppliers**, main barrier identified is high price/cost (mentioned by 2/2 interviewees), as summarized in Figure 4.12. Suppliers mention including sustainability makes their bids more expensive ultimately leading to them not being awarded the project. Other barriers identified are the role of client (mentioned by 1/2 interviewees), mindset (mentioned by 1/2 interviewees), changing project drivers (mentioned by 1/2 interviewees) and generic requirements (mentioned by 1/2 interviewees).

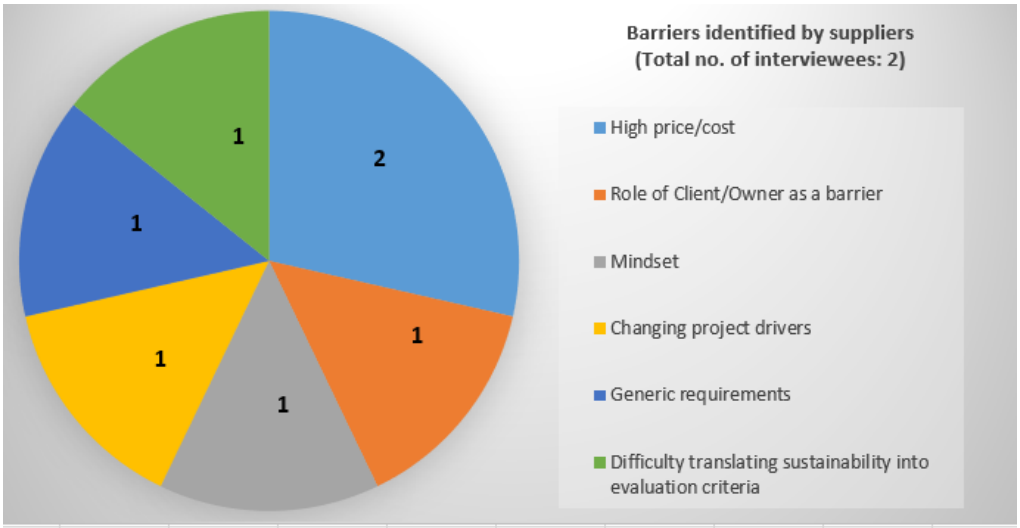

Figure 4.12 Frequency of barriers identified by suppliers

It is interesting to note that high price/cost and the role of the client or owner are common barriers mentioned by all actors. This is because of the strong influence the price/cost of sustainable procurement can have on selecting a sustainable option over a traditional one. It is also noteworthy that EPC company, (sub-)contractors and suppliers mention the role of client/owner as a significant barrier to sustainable procurement. This emphasizes the importance clients play in stimulating or triggering sustainable procurement practices, as well as the significant constraint of cost/price in integrating sustainability into procurement.

4.5 Prioritization of performance indicators identified in conceptual sustainability framework

This section describes one of the major findings from data analysis: how can the performance indicators identified in the conceptual sustainability framework (SF.3, Table 3.2) be prioritized based on interviewee responses. The goal of this prioritization is to understand which performance indicators are most relevant in practice, as well as to link the sustainability framework developed to the industry and practice and ultimately answer SQ4. Additionally, any performance indicators that interviewees mentioned could add value when integrated into the conceptual framework were also addressed.

4.5.1 Procedure for prioritizing the performance indicators

During the semi-structured interviews, interviewees were shown the sustainability framework developed and asked to prioritize each performance indicator (based on their experience) into three groups:

Extremely important to know (e) Important to know (i) Good to know (g)

The purpose of these rankings was to identify those performance indicators that interviewees found was extremely important to know during procurement from their suppliers/(sub-)contractors, important to know or good to know. Once all the rankings were provided, a scoring or weightage was assigned to each group, with the performance indicators identified as extremely important to know having the highest weightage.

Extremely important to know (e) – weightage 3

Important to know (i) – weightage 2

Good to know (g) – weightage 1

Based on the above weightages the mean was calculated for each indicator, and the 'Sustainability Framework' was redesigned as per the new prioritization scores. No indicators were removed from the framework, to ensure that the framework remained flexible enough to be implemented according to changing client requirements, project drivers and supply chain capabilities. The procedure followed is summarized in Figure 4.3 and Appendix 3c shows the prioritization/weightage given by the interviewees for each indicator in the framework.

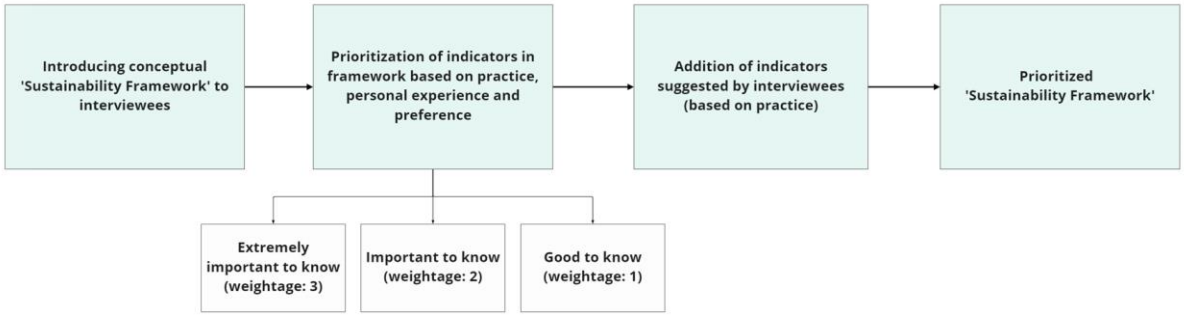

Figure 4.13: Procedure for prioritizing indicators in the conceptual sustainability framework

4.5.2 Introducing the prioritized "Sustainability Framework"

The semi-structured interviews provided the link to practice needed to connect the conceptual framework to the industry in which it could be potentially integrated. The additional performance indicators considered in practice, the importance of each performance indicator and any potential measurement methods available were all crucial findings from the interviews.

The results combined lead to the final version of the 'Sustainability Framework (SF.4)" as seen below, including the environmental and social aspects of sustainability and its corresponding criteria and performance indicators, being developed.

Table 4.6 thus shows the sustainability framework to be adopted in practice, focussing on environmental (E) and social (S) aspects. A total of 12 environmental (E1-E12) and 9 social (S1-S9) criteria were developed along with 34 environmental (E1.1-E12.2) and 22 social (S1.1-S9.1) performance indicators. The sustainability framework was prioritized based on interviewee prioritization feedback (Appendix C.3a). For example, in the initial sustainability framework developed (section 3.3, Table 3.2), for the first environmental criteria (E1), the corresponding performance indicators were green purchasing/green procurement (E1.1), responsible and local sourcing (E1.2) and maximize resource efficiency (E1.3). But as per interviewee feedback and prioritization, the indicators were rearranged such that: maximize resource efficiency was considered extremely important to know (E1.1), followed by green purchasing/green procurement (E1.2) and responsible and local sourcing (E1.3). Additionally, performance indicators E3.2: Opportunity to use second-hand equipment, S1.3: PayOK certificaat and S2.5: VCA (Veiligheid, Gezondheid en Milieu Checklist Aannemers)/ VCA P veiligheidscertifcaat, were added as per interviewee feedback.

The below Table 4.6 thus depicts the final prioritized and rearranged framework (including any additional aspects mentioned). This sustainability framework is proposed to EPC companies to be included in their project procurement practices.

Table 4.6: Final Sustainability Framework (SF.4, developed for integration into procurement practices of EPC companies

TBL aspect	Criteria	Performance indicators
ENVIRONMENTAL	**Environmentally conscious purchasing (E1)**	Maximize resource efficiency (E1.1)
		Green purchasing/Green procurement (E1.2)
		Responsible and local sourcing (E1.3)
	Green Supply Chain Management (E2)	Suppliers (Tier 1, Tier 2) environmental responsibility and performance (Inbound logistics and procurement, Materials Management, Outbound logistics, Packaging, Reverse logistics) (E2.1)
	Environmental performance (E3)	Material efficiency-Opportunity for material Reduce, Reuse, Recycle, Remanufacture and Disposal and Disassembly (E3.1)
		Opportunity to use second-hand equipment (E3.2)
		Local environmental impact (E3.3)
		Environmental considerations made (Environmental efficiency of operating procedures, use of sustainable materials, Biodegradable/compostable (%), Emissions and waste (per unit of product), Pre/post-consumer recyclable content (%), Recyclable item (% of total), Volume of waste sent to landfill, renewable fuels used, use of ozone depleting substances) (E3.4)
		Environmental certification (LEED/Ecovadis/CSR) (E3.5)
		Spill prevention plans (plans+methods of containment for different spills/spill response to different substances) (E3.6)
		Environmental stewardship (processes and technologies focusing on increased environmental stewardship) (E3.7)
		Use of conflict minerals (tin, tungsten, tantalum, gold) (E3.8)
	Pollution Control and Waste Management (E4)	Waste reduction strategies: (1) Can waste be recycled rather than sent to a landfill? 2) Can disposal in landfills or incinerators be minimized? 3) Can unused materials be returned to suppliers? 4) Can equipment packaging be returned to suppliers? 5) Can environmentally preferred products (ones that are easier on the environment) be used?) (E4.1)
		Site waste management plan (Including Waste minimization plans such as (E4.2): (1) Eliminating equipment pieces or connections where possible 2)Modifying or replacing standard equipment pieces, for example, using seal-less pumps 3)Using design practices that provide early detection of losses (e.g., aboveground tanks and piping) 4) capture and recycle to prevent or minimize waste generation 5) carry out 'process stream inventory" to consider streams with potential to generate waste)
		Pollution Control (pollution factors constituted from the supplier production and service processes and product components. Related with air emissions, wastewater, spills noise, soil, odor and solid wastes) (E4.3)

TBL aspect	Criteria	Performance indicators
ENVIRONMENTAL	**Management of hazardous substances (E5)**	Hazardous substances management (requirements facilitating safe handling, use, storage and disposal of hazardous chemicals/materials/substances) (E5.1)
		Design of products to avoid or reduce use of hazardous products and their manufacturing process (E5.2)
		Regulations on use of hazardous substances (E5.3)
		Hazardous air emissions (CFC's, EtO, MEK, Toluene, etc.) (E5.4)
	Life cycle Assessment (E6)	Life Cycle Analysis (E6.1)
		Life Cycle Costs, Net Life Cycle Costs (E6.2)
	Environmental regulations/Environmental compliance (E7)	Environment related certificates (ISO 14000/ISO 14001/ EMAS/ AS NZS ISO 14001) (E7.1)
		Environmental compliance with environmental laws and regulations (also local regulations such as having CO2 scrubbers or denox installations for exhaust emissions) (E7.2)
	Environmental Management Systems (EMS) (E8)	EMS Program Development, Implementation, and Evaluation (E8.1) - Pollution Prevention and Waste Minimization Programs - Sustainability Programs - Energy Efficiency Programs - Air, Water, and Soil Monitoring - Permit and Consent Coordination - Air Dispersion Modeling - Environmental Impact Assessment - Spill Prevention/Control Countermeasure Planning - Environmental Audit/Assessments - Waste Disposal Planning
		Existing environmental management systems (E8.2)
	Energy efficiency (E9)	Reduction in energy consumption (both direct (natural gas, diesel, gasoline) and indirect energy use (for electricity)) (E9.1)
		Use of renewable energy (E9.2)
		Amount of energy and efficiency required for the products manufacture and assembly (amount of energy used per unit of product) (E9.3)
	GHG emissions/Carbon footprint/ Carbon management (E10)	Carbon reduction in project execution, operations and maintenance (E10.1)
		Reduction and evaluation of CO2 emissions and CO2 footprint (e.g.: Co2 prestatieladder) (E10.2)
		Carbon reduction targets in project execution, operations, and maintenance (E10.3)
	Product stewardship (E11)	Design for the environment (E11.1)
	Green competencies (E12)	The type of materials making up the supplied component (E12.1)
		Availability of clean technologies (E12.2)

TBL aspect	Criteria	Performance indicators
SOCIAL	**Employment practices (S1)**	Diversity, Equity, and Inclusion (S1.1)
		Corporate code of conduct (S1.2)
		Employee benefits (such as dialogue with employees, training and education, employment stability, career development, working hours, wages and benefits, security and welfare, privacy, PayOK certificaat) (S1.3)
	Health and safety (S2)	Health and safety of employees and community (S2.1)
		Accident prevention and exposure to harmful materials or process or health risks (S2.2)
		Safety total case incident rate (TCIR) (S2.3)
		Operational facilities are ISO 45001/ OHSAS 18001 certified (S2.4)
		VCA (Veiligheid, Gezondheid en Milieu Checklist Aannemers)/ VCA P veiligheidscertifcaat (S2.5)
	Local Community Influence (S3)	Skills enhancement of local workforce (S3.1)
		Community dialogue and engagement (S3.2)
		Investment in local community and community involvement (S3.3)
		Diverse and local suppliers (S3.4)
	Stakeholder's influence (S4)	Stakeholder relations and participation (S4.1)
		Information provision (S4.2)
	Company efforts (S5)	Social responsibility efforts (S5.1)
		Training and programs for employees for green consciousness (S5.2)
		Environmental image of company (S5.3)
	Discrimination (S6)	Discrimination in employment (age, religion, gender, and other similar factors) (S6.1)
		Racial or sexual discrimination and harassment (S6.2)
	Child labor and rights (S7)	Measures to prevent or eradicate child or forced labor (S7.1)
	Employee and stakeholder rights (S8)	External stakeholder human rights (e.g., local communities, civil society) (S8.1)
		Rights of indigenous people (S8.2)
	Contribution to society (S9)	Tools and resources to support community building, charity, volunteering (S9.1)

4.6 Chapter 4- Semi structured interviews conclusion and next steps

The main aim of semi-structured interviews (main empirical data collection method) was twofold: first, to identify the enablers and barriers to integrating sustainability into the procurement practices of EPC companies. Second, to prioritize the performance indicators identified in the sustainability framework developed in the previous chapter (section 3.3, Table 3.2) to understand the importance given to each indicator.

Initially, exploratory interviews are conducted to identify projects/case studies within the case company that have integrated sustainability in any or all project phases. A total of 10 exploratory interviews were conducted, resulting in 7 identified case studies (5 from E&C and 2 from Infrastructure). The aim of identifying infrastructure projects was to understand the difference between the infrastructure and E&C industry, as well as see what lessons could be learnt from infrastructure. The case studies were used as a starting point to identify related Client, EPC(Fluor) and SC (suppliers/(sub-)contractors) actors involved with the project. Professionals who were part of the sales and procurement and contracts (P&C) department at Fluor were approached, along with P&C professionals from the client side and sales/P&C professionals from SC. In case relevant people were not identified, practitioners who can add most impact were approached. A total of 19 interviewees were identified (8 Fluor, 5 Client, 4 contractor and 2 supplier). The semi-structured interviews were then conducted focusing on six themes to ensure structured content during interviews. The themes explored expert understandings on the topic of sustainable procurement, the prioritization of performance indicators, the enablers and barriers faced in the industry, current practices and so on. The data was then analysed using ATLAS.ti and open coding. A total of 145 main codes were assigned to the various insights gathered during the interviews. This provided a broader overview on the feedback and comments provided by interviewees.

The main findings from the semi-structured interviews included the identification of enablers and barriers to integrating sustainability into procurement, the prioritization of the sustainability framework developed and recommendations for EPCs, Clients and SC actors.

A total of 14 enablers and 19 barriers to integrating sustainability into procurement were identified from the interviews. Among the identified enablers, mindset of the people or culture of the company was considered the most important enablers to sustainable procurement by clients (Figure 4.4). EPC interviewees identified price/cost and role of the client/owner as major enablers (Figure 4.5) while supply chain actors agreed on the importance of price/cost and government legislations as important enablers (Figures 4.6 & 4.7). Similarly, among the identified barriers, clients mentioned high price/cost as a major barrier (Figure 4.9) while the role of the client/owner was mentioned as a major barrier by EPC interviewees (Figure 4.10). Similarly supply chain actors also mentioned high price/cost and the role of client/owner as major barriers to integrating sustainability into procurement (Figures 4.11 & 4.12).

It is interesting to note that high price/cost and the role of the client or owner are common barriers mentioned by all actors. This is because of the strong influence the price/cost of sustainable procurement can have on selecting a sustainable option over a traditional one. It is also noteworthy that EPC company, (sub-)contractors and suppliers mention the role of client/owner as a significant barrier to sustainable procurement. This emphasizes the importance clients play in stimulating or triggering sustainable procurement practices, as well as the significant constraint of cost/price in integrating sustainability into procurement.

Following the identification of the enablers and barriers, the conceptual sustainability framework developed from literature and document review (section 3.3, Table 3.2) was prioritized. The aim of prioritizing the framework was to identify which performance indicators were mentioned as most important by the interviewees. The prioritization was done by asking interviewees to rank each performance indicator as: extremely important to know, important to know and good to know. Then each level was given a weightage with extremely important to know having the highest weightage and good to know having the lowest. The mean was then calculated of all interviewee responses.

From the prioritization provided by interviewees, the conceptual sustainability framework was synthesized and rearranged. Ultimately including 12 environmental criteria and 34 performance indicators and 9 social criteria and 22 performance indicators. Additionally, any other performance indicators mentioned by interviewees were included into the framework.

From the prioritization provided by the interviewees in the different organizational roles, it was also observed that:

For clients, the performance indicators corresponding to environmental criteria considered most important were maximizing resource efficiency and designing products to avoid or reduce use of hazardous products and their manufacturing process. Among performance indicators corresponding to social criteria, discrimination in employment and racial discrimination were considered important. For EPC (Fluor), the performance indicators corresponding to environmental criteria considered most important were hazardous substances management and environmental certification. While those corresponding to social criteria included measures to prevent or eradicate child or forced labour and discrimination in employment. For (sub-)contractors, site waste management, hazardous substances management and environmental related certificates were most important environmental criteria related performance indicators. While discrimination in employment, racial discrimination and health and safety of employees were important social criteria related performance indicators. For suppliers, waste reduction strategies, hazardous substances management and environmental related certificates were important performance indicators corresponding to environmental criteria. While diversity, equity and inclusion, employee benefits, corporate code of conduct were few of the important performance indicators identified corresponding to social criteria. A summary of all the prioritization can be seen in Appendix C.3a, C.3b and C.3c.

The barriers identified from the interviews are prioritized and mitigation steps recommended in the subsequent chapter (Chapter 5) to ensure effective integration of sustainability/framework into procurement. The recommendations provided during the interviews are addressed further in the subsequent chapters along with a strategy or plan of action on how the final prioritized sustainability framework developed, can be introduced into the procurement practices of an EPC company. These steps together form the basis for developing a solution to integrating sustainability into the project procurement practices of an EPC company.

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PHASE 3

DEVELOPING THE SOLUTION & EXPERT EVALUATION

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CHAPTER 5
DEVELOPING THE SOLUTION
&
EXPERT EVALUATION

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CHAPTER 5: DEVELOPING THE SOLUTION & EXPERT EVALUATION

This chapter analyzes the results from the semi-structured interviews and provides recommendations to the EPC company on how sustainability can be potentially integrated into their project procurement practices. This will thus answer SQ4 and ultimately answer MRQ.

SQ5 How can the sustainability framework developed be applied in practice?

MRQ How can sustainability be integrated into the procurement practices implemented across all project phases of an EPC company?

This chapter is structured as follows: developing the strategy or solution to integrating sustainability into the procurement practices of an EPC company begins with addressing the barriers identified in section 4.4 and determining possible measures to tackle these barriers (5.1). Once the identified barriers have been addressed, the developed sustainability framework can be introduced into practice (5.2). Additionally, insight and recommendations gathered from data analysis is also described to understand additional steps that can be taken for better integration of sustainability into procurement (5.3). Potential takeaways from the infrastructure industry is briefly explored (5.4). The barriers identified and the steps to mitigate them, the final framework developed, and the additional recommendations are all validated by an expert panel (5.5). Finally, the chapter summary and next steps are described (5.6).

5.1 Prioritizing and tackling the barriers to integration of sustainability into procurement

Before the sustainability framework can be integrated into procurement, the barriers hindering its implementation need to be prioritized and tackled. Prioritizing the barriers provides EPC companies with the understanding of the barriers that could have the most negative impact on sustainability integration into procurement and how they could be potentially addressed.

5.1.1 Prioritizing identified barriers to integrating sustainability into procurement

The barriers identified in section 4.4 need to be prioritized to identify those barriers having the maximum impact on integrating sustainability into the procurement practices of an EPC company. The barriers can then be tackled to ensure that sustainability can be successfully integrated into project procurement practices.

The "*Barrier Identification and Mitigation tool*" is used to summarize and prioritize the barriers and take actions to remove or mitigate the barriers (Gurses et al., 2009). The barriers are prioritized based on two criteria:

- Likelihood: so how likely is this barrier to occur or probability of occurrence
- Severity: how severely can this barrier impact the integration of sustainability into project procurement

The **likelihood score** is divided into four categories:

1. Low 2. Moderate 3. High 4. Very high.

Similarly, the **severity score** is also divided into four categories:

1. Low 2. Moderate 3. High 4. Very high.

Then, both the likelihood score and the severity score are multiplied to calculate the **barrier priority score**.

Appendix D.1 summarizes the barriers identified in section 4.4 with their corresponding likelihood and severity score. The barrier priority score and the rationale for selecting these likelihood and severity scores is also briefly explained (Table 5.1). The barriers were each given a likelihood score based on their occurrence in ATLAS.ti (so the number of quotations or interviewee responses associated to the code). The severity score was based on the impact each barrier would have on implementing sustainability in project procurement. It was determined based on interviewee reasoning as to why a certain barrier can impact sustainability integration into procurement. Additionally, the overall reasoning given by all interviewees was also analyzed while assigning the severity score. For example, the barrier “Lack of governmental regulations” was not mentioned by many interviewees. But those that mentioned it, agreed that legislations or regulations are a definite way to integrate sustainability into procurement. Hence it was given a high severity score due to its impact in integrating sustainability into procurement. Table 5.1 depicts an overview of the barriers to integrating sustainability into procurement identified and their priority scoring based on likelihood and severity.

Table 5.1: Barrier priority scoring for barriers identified to integrating sustainability into procurement

	BARRIERS	LIKELIHOOD SCORE (1)	RATIONALE	SEVERITY SCORE (2)	RATIONALE	BARRIER PRIORITY SCORE (1x2)
1	High Price/Cost	4	Sustainability is considered only if its economically beneficial or cheap	4	If integrating sustainability into procurement costs more, hard to motivate clients	4x4=16
2	Role of Client/Owner as a barrier	4	Clients always play a deciding role in every project	4	Integrating sustainability into procurement is based on client focus	4x4=16
3	Traditional industry	3	Many industry projects still very traditional in execution	4	Hard to promote sustainable procurement in a traditional industry	3x4=12
4	Mindset	3	Most people understand importance of SP. But in practice people still think "current way works so why change?"	3	If people don't give a focus to integrating sustainability into procurement, implementation becomes challenging	3x3=9
5	Changing project drivers	3	Internal or external pressures can change project drivers	4	If the drivers for the project are cost, time, budget etc., then sustainability loses focus	3x4=12
6	Single/sole source	3	Due to unique processes and projects in the E&C industry, equipment or material alternatives are hard to find	4	If there is no suitable alternative that is within budget and other project requirements, resources will be selected that are readily available and within budget and time	3x4=12
7	Generic requirements	3	Most projects have very generic requirements regarding sustainability. Few aspects are also included in HSE	3	Generic requirements make it hard to measure or evaluate the sustainability performance of supply chain actors	3x3=9
8	Window-dressing/Greenwashing	3	Sometimes actors will only highlight few sustainability aspects to have a green image	2	Gives clients incorrect view on the sustainability capabilities of bidders	3x2=6

	BARRIERS	LIKELIHOOD SCORE (1)	RATIONALE	SEVERITY SCORE (2)	RATIONALE	BARRIER PRIORITY SCORE (1x2)
9	Strong competition	3	Within the industry there is a strong competition for bid award	3	Supply chain actors will not try other sustainable options as it would make their bid more expensive, and they would lose to competition	3x3=9
10	Convenience	2	Most projects in process industry are time & budget driven, and they look at convenience of integrating sustainability	3	If sustainable procurement is not convenient, it will not be considered for integration into projects	2x3=6
11	Lack of knowledge	2	Actors are not completely aware what to ask from their SC regarding sustainability (unless clients specify)	3	Not knowing what to ask means sustainability is not considered during procurement, unless requirements are present	2x3=6
12	Difficulty translating sustainability into evaluation criteria	2	Often sustainability even if asked or proactively mentioned by supply chain actors cannot be translated into evaluation criteria	3	Unless sustainability efforts of actors can be measured (qualitatively or quantitatively) they cannot have an impact on project procurement	2x3=6
13	Ambitions regarding sustainability in procurement	2	Companies need to have ambitions regarding sustainability integration into procurement	3	Unless there is a focus or a strategy from the organization side, sustainability will remain a 'good to have' aspect during procurement	2x3=6
14	Sustainability in project vs procurement	2	E&C industry projects look more into having a process/technology that is sustainable more that vendors/materials/equipment	4	Clients counter that the impact that a whole energy neutral plant has is more than having a single equipment with low emissions. This makes promoting sustainability in procurement difficult.	2x4=8
15	Lack of governmental requirements	1	Within the process industry there are no regulations regarding sustainable procurement	4	Lack of regulations means actors are not being enforced to look at sustainability during their procurement process	1x4=4

	BARRIERS	LIKELIHOOD SCORE (1)	RATIONALE	SEVERITY SCORE (2)	RATIONALE	BARRIER PRIORITY SCORE (1x2)
16	Silos within the organization	1	Organizations can have a corporate silo, a project silo, a HSE silo, each with individual focus meaning focus on sustainability gets fragmented	3	If no coordination and collaboration exist, sustainable procurement will not be given focus or will only be thought of within an individual silo (eg: environment in HSE) and not integrated	1x3=3
17	Sustainability as a sales tool	1	Sustainability is currently thought of as a promotion tool to show the market how environmentally conscious a company is	2	The focus given to sustainability implementation in projects reduces	1x2=2
18	Lack of transparency	1	Current procurement system does not mention how supply chain is being evaluated on sustainable aspects (if any)	2	Lack of transparency leads to less sharing of information and knowledge ultimately hindering sustainability integration into procurement	1x2=2
19	Lack of discussion	1	Projects don't often have discussions among all actors involved in the project on sustainability (Client-EPC-Supply Chain)	3	Lack of discussion within the project chain means that the different capabilities and ambitions of the actors remain unknown and progress towards sustainability is less	1x3=3

5.1.2 Recommendations to mitigate the barriers

Once the barriers have been prioritized, the next step is to provide **recommendations to EPC companies** to mitigate these barriers to ensure successful implementation of sustainability into their procurement practices.

[1] High price/cost (Barrier priority Score: 16)

This barrier can be mitigated by:

- *Creating awareness*: awareness needs to be created that even if sustainability is initially more expensive, it is more cost efficient in the long-run due to improved energy efficiency, material usage, etc.
- *Logistics management*: Looking into sustainability during supply chain logistics and transportation can potentially create cost savings generated by optimized vehicle usage, distance reduction and alternate/reduced fuel consumption, ultimately reducing costs as well as sourcing sustainably.
- *A Total Cost of ownership (TCO) perspective*: Looking at the TCO will help companies understand the total direct and indirect costs associated with the purchase of a particular product. This will give an idea about the long-term value of choosing a sustainable product. So even if initial capital investment may be higher when looking at sustainability, but due to increased energy price, carbon tax, material prices, etc., operation costs will be lower. This is because investing in more durable equipment will save costs during operations in energy consumption, labour, and maintenance.

[2] Role of client/ owner as a barrier (Barrier Priority Score: 16)

This barrier can be mitigated by:

- *Creating awareness*: There should be open discussions and conversations with clients regarding the added value of procuring sustainably. EPCs can help by demonstrating to clients the added value of sustainability in procurement and presenting sustainable alternatives that still maintain the requirements of quality, safety but are greener.
- *Client role*: Clients need to be made aware of the central role they play in pushing the topic of sustainability from EPCs/suppliers/(sub-)contractors. This will also help them gain better market image, more investors and a better public opinion thus giving them a competitive advantage.
- *Linking sustainability to better project performance*: Discussions on how sustainability can help to create a greener and more efficient project can potentially help clients understand the value in integrating sustainability into procurement. For example, discussions with clients about how including sustainability in sourcing decisions can contribute to reducing the projects and the company's environmental impact (especially when transporting bulk raw materials).

[3] Traditional industry (Barrier Priority score: 12)

This barrier can be mitigated by:

- *Discussing changing industry conditions*: By having discussions on the current shift in the market and impact sustainable procurement processes can have on company image and public opinion. The traditional industry clients also need to be made aware of the value in diversifying their

portfolio to include sustainable project and processes so that they are in line with changing customer, investor, and employee expectations

- *Governmental regulations*: Traditional industry clients need to be made aware of the growing governmental regulations pushing oil, gas and energy companies to look for more sustainable solutions to meet the carbon-neutral targets. So, to be able to operate and meet carbon-neutral targets, companies need to look at sustainable alternatives.

[4] Changing project drivers (Barrier Priority Score: 12)

This barrier can be mitigated by:

- *Role of procurement department*: The procurement professionals need to be motivated to still look at sustainability during procurement. This can be achieved by raising awareness through responsible procurement trainings or discussions. Additionally, other departments such as engineering can also help procurement professionals interpret how sustainable an alternative solution is.
- *Develop a business case for sustainability*: Developing a business case for setting aside extra budgets or funding for looking at sustainable options. This will ensure that even if project drivers change, sustainability can still be considered.

[5] Single/Sole source (Barrier Priority Score: 12)

This barrier can be mitigated by:

- *Sustainable alternatives when possible*: Even if entire equipment is single source (like kilns, etc), alternatives can be considered in the connecting pipes (reused/slotted steel), cable trays, scaffolding, etc. Alternate designs and methods like modular construction, using bolted instead of welded connections are also options how sustainability can be integrated into the process industry projects. Additionally looking at second-hand static equipment (so equipment with no rotating parts like vessels, heaters, etc) can also help introduce sustainability into the project.
- *One to one replacement*: Look at sustainable alternatives for one-to-one replacements. For instance, if compressor or a cooler need to be replaced because the old one is broken, look at selecting a more sustainable alternative, either refurbished, second-hand, etc.

[6] Mindset (Barrier Priority Score: 9)

This barrier can be mitigated by:

- *Improving awareness*: Awareness should be created among all actors involved in the project chain regarding the importance and benefits of sustainability in procurement. This can be done through campaigns, incentives or penalties. Campaigns or portfolios driven down from top management can also help push this topic further.
- *Workshops and training platforms*: Workshops, training for employees to raise green awareness, sharing ideas and discussing possible sustainable options will help develop a positive mindset and attitude towards sustainability in procurement.

[7] Generic requirements (Barrier Priority Score: 9)

This barrier can be mitigated by:

- *Setting targets and requirements*: EPC companies should look at setting quantifiable sustainable procurement targets in collaboration with clients and converting them into benchmarks/indicators and limits. Discuss with clients during initial meetings on how they can help formulate requirements in bids for sustainable procurement, and how this could lead to suppliers/contractors who are technically and commercially compliant, but sustainable as well.
- *Integrating sustainability into bid evaluations*: EPC companies can also look at providing a scoring or award criteria for sustainability in their technical/commercial bid evaluations.

[8] Strong competition (Barrier Priority Score: 9)

This barrier can be mitigated by:

- *Incentivize sustainability from suppliers/(sub-)contractors*: Providing incentives for sustainable efforts and behaviour can trigger supply chain to consider sustainability aspects even if expensive. Also giving an award advantage to actors that have sustainability ambitions or demonstrate sustainability efforts and goals can also trigger supply chain actors to look at sustainability in their bids.

[9] Sustainability in project vs procurement (Barrier Priority Score: 8)

This barrier can be mitigated by:

- *Creating awareness*: There is a need to create understanding and awareness among clients and EPCs that in order to achieve sustainability looking at the project perspective alone is not enough. It should also be looked at from a supply chain perspective. A potential step could be by looking at the sustainability profile of suppliers (Scope 3) at prequalification stage and making it visible to clients on who they work with. Also, by mentioning that having a green project but materials shipped from far away or a supplier with a negative social image, adversely impacts the project goals and the sustainability ambitions the project is trying to achieve.

[10] Window-dressing/Greenwashing (Barrier Priority Score: 6)

This barrier can be mitigated by:

- *Specific and focused discussion*: Having focused discussions with supply chain actors on how sustainability can be implemented in the project is important. Discussions on examples of similar projects executed, where sustainability was considered during procurement can be helpful. Also, having discussions on the potential of supply chain actors to implement sustainability in their process, etc., can help understand what could actually be implemented in projects and not just from a greenwashing perspective.

[11] Convenience (Barrier Priority Score: 6)

This barrier can be mitigated by:

- *Understanding the convenience in sustainability*: Creating awareness that due to uncertainties, instability and complexities faced in the current economy and stricter regulations for emissions reductions, it is more beneficial to procure sustainably. This will ultimately help lower supply chain risk and uncertainty in terms of procuring long lead items or complexities regarding logistics, etc.

[12] Lack of knowledge (Barrier Priority Score: 6)

This barrier can be mitigated by:

- *Driving change through collaboration:* Collaboration among all actors involved in the project chain (Client-EPC-Supply Chain) to look at how sustainability can be integrated into project procurement can help all parties involved share knowledge and expertise. Another effective step is taking part in knowledge networks, groups or sharing platforms that discuss and promote sustainability.
- *Knowledge transfer*: Greater knowledge transfer between academic researchers and practitioners on improved implementation of sustainable procurement strategies can also help improve knowledge on the topic.

[13] Difficulty translating sustainability into evaluation criteria (Barrier Priority Score: 6)

This barrier can be mitigated by:

- *Scoring sustainability in technical bid evaluations*: EPC companies and clients can develop evaluation criteria (as pre project requirements) that can be integrated into bid requirements.
- *Conducting audits and performance evaluations as a first step*: Even though there are no industrywide standards or benchmarks, companies can conduct audits and performance measurement progress meetings to determine the sustainability performance of supply chain actors.
- *Opportunities for improvement*: Even if SC actors do not have sustainability certificates or goals at the moment, they should still be given the opportunity to improve and provide such targets during project lifetime, if they need to be awarded the project

[14] Ambitions regarding sustainability in procurement (Barrier Priority Score: 6)

This barrier can be mitigated by:

- *Align sustainability goals with company goals*: EPC companies should align their mission and vision statement with sustainability goals as well. They need to recognize that sustainability positively impacts their credibility and image of being environmentally and socially responsible. This will also help companies win tenders, gain new investors or shareholders and positively impact the stakeholders. They should also communicate differently within the organization to ensure everyone is invested in sustainability
- *Seeing sustainability as a value creation topic*: A strong business case needs to be made to focus on how sustainability can be integrated into projects. It should be seen as an 'added value/value creation topic' that can positively influence projects.

- *Seeing sustainability as a differentiating factor*: Companies need to look at the increased competition in the market and see how they can differentiate themselves through having sustainable processes.
- *Creating a 'sustainability pitch'*: Most company presentations start with a safety pitch where the importance of safety in projects, value of having no accidents etc. are discussed. Similarly having a 'sustainability pitch' will help create awareness that sustainability is also given importance in projects. Interviewee CL1 mentioned "especially on bigger meetings, they start with this safety topic. Yeah, right. Well, let's, let's change that and make that 50 50 environmental topic. How can we do stuff better? But let's start doing that."

[15] Lack of governmental requirements (Barrier Priority Score: 4)

This barrier can be mitigated by:

- *Taking part in industry-wide consensus*: To have industry wide consensus that sustainability in procurement should be made pre-requisite in order to accelerate the transition towards sustainable procurement (but this is a slow change and cannot be influenced by a single company).

[16] Silos within the organization (Barrier Priority Score: 3)

This barrier can be mitigated by:

- *Aligning sustainability goals between the different departments*: Discuss the importance of having interconnected organizational ambitions where all actors involved are jointly focussed on sustainability. So having engineering, procurement, HSE, business development and other departments aligned to drive sustainability and choice of sustainable supply chain actors.

[17] Lack of discussion (Barrier Priority Score: 3)

This barrier can be mitigated by:

- *Bottom-up approach*: Create understanding on how adopting a bottom-up approach can be beneficial in understanding supply chain capabilities and seeing how EPCs and Clients can support supply chain actors thus promoting sustainability within the project, company and downstream in procurement.
- *Early supplier/contractor involvement*: Having suppliers/(sub-)contractors involved early in the project so that they can give their input on alternative sustainable designs. As getting involved late in the project causes them to follow specifications already set and not have room to maneuver.
- *Follow-up on SC sustainability efforts*: Follow up on the sustainability aspects mentioned by SC actors, so that they know it is being looked at within the company and in projects. Interviewee CO2 mentioned "when we share proactively our CSR certificate or co2 reduction, that should be Oh, that's very good that you have that. But we never receiving positive feedback."

[18] Sustainability as a sales tool (Barrier Priority Score: 2)

This barrier can be mitigated by:

- *Ask detailed information from SC actors*: Instead of discussing generic details with supply chain actors like them mentioning 'we can do this'/'we can do that', ask SC actors to show what they can do to embed sustainability in projects, show references of similar projects done, discuss opportunities to consider sustainability in different phases of the project.

[19] Lack of transparency (Barrier Priority Score: 2)

This barrier can be mitigated by:

- *Long-term relationship management*: EPC companies should look at developing long term relations with clients and supply chain actors through openness and transparency. This topic can be potentially included in an EPC company's strategic goals and meetings. Being transparent about how supply chain actors will be evaluated regarding sustainability, having a partly open-book system to help clients see that the additional costs are not due to EPCs keeping a higher profit margin, but the costs are associated to sustainable efforts alone, will garner a sense of trust among the actors thus strengthening sustainability efforts.

5.2 Introducing the sustainability framework into procurement

Once the barriers addressed have been tackled, the sustainability framework can be successfully integrated into the procurement practices of an EPC company. The areas identified in Figure 5.1 are the procurement documents involved along the different project phases within an EPC company such as FCBV. This figure gives an indication to the areas along the project timeline, where the sustainability framework developed could be potentially integrated.

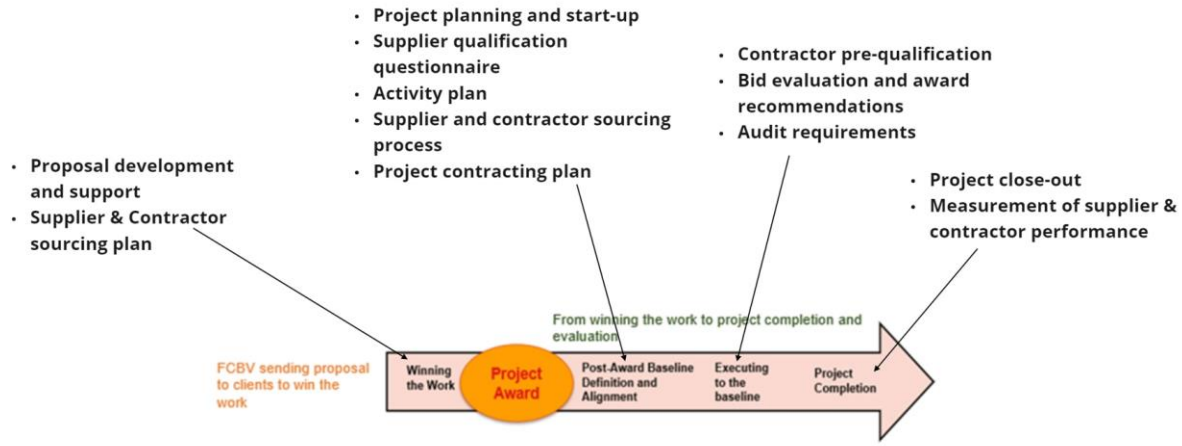

Figure 5.1 Potential areas where sustainability can be integrated into procurement practices implemented across the project phases

For example, in winning the work phase, during proposal support, EPC companies can pro-actively mention to clients the sustainability ambitions they are willing to achieve downstream through the

sustainability framework. They can also mention to clients in their sustainability write-up or during client discussions, the number of green projects executed, the number of sustainable suppliers/(sub-) contractors selected, green sourcing strategies and so on. This will set them apart from competition and show clients the focus they have on sustainability within procurement. In the baseline definition and execution phases, the sustainability framework can be integrated into pre-qualification documents sent out to suppliers and contractors to ascertain their sustainability capabilities and ambitions. Finally, during project completion, it can be determined if the suppliers/(sub-)contractors have integrated the sustainability indicators as mentioned. Their performance can also be evaluated or measured through audits or by using a similar questionnaire format.

In this research study, the focus is on **qualitatively** assessing the sustainability level of an EPC company's suppliers/(sub-)contractors. Thus, the indicators identified in the sustainability framework can be used to enquire (by asking the questions, Yes/No) and evaluate the sustainability aspects of supply chain actors. The integration of the framework into the procurement practice documents, will depend on the context in which it is being used (as mentioned earlier).

Since integrating the sustainability framework into prequalification documents sent out to suppliers/(sub) contractors can have the most impact, potential action plans are discussed below. When EPC companies introduce the "Sustainability Framework" to their suppliers/(sub-)contractors in pre-qualification or selection documents, it can be done in two ways.

1. Either provide SC actors with a general questionnaire to gauge their ambitions regarding sustainability and then introduce the detailed sustainability framework.
2. Or, if EPC companies are already aware of the sustainability ambitions of the SC actors, they can directly introduce the sustainability framework to gather detailed insight on SC environmental and social sustainability ambitions.

A sample format of the two strategies is proposed below to give EPC companies an idea on how sustainability (through an inclusive questionnaire or through the sustainability framework) could be potentially integrated into their procurement practices:

Strategy 1: Introducing an inclusive questionnaire to suppliers/(sub-)contractors during selection and evaluation

ITEM NO.	QUESTION	RESPONSE TYPE	SUPPLIER/CONTRACTOR RESPONSE
A	**Sustainability**		
1.0	What ambitions or goals do you have within your company regarding sustainability?	Text	
2.0	How do you think you can make this project more sustainable? (It can be in terms of reduced energy consumption, inovative design or process ideas, carbon reduction targets, etc)	Text	
3.0	Can you provide examples of projects your company has executed in a sustainable manner?	Text	
4.0	What added value can you bring to the project in terms of sustainability?	Text	
5.0	What long term vision or strategy does your company have in integrating sustainability into your organization, the projects you execute, the materials and services you provide and the people you employ?	Text	

Figure 5.2 Sample inclusive questionnaire regarding sustainability to introduce to suppliers/(sub-)contractors

By asking these broad questions, the ambitions and goals supply chain actors have regarding sustainability can be assessed. Additionally, their capabilities can be evaluated in terms of their long-term vision and the direction they wish to achieve regarding sustainability.

Strategy 2: Introduce the detailed sustainability framework developed to assess the different sustainability criteria and performance indicators of the suppliers/(sub-)contractors. Additionally, a column is also dedicated to future plans they may have to achieve or implement these sustainability actions. This also ensures that, even if they don't have such actions currently, their willingness and ambition to implement them in the future can be understood.

ITEM NO.	QUESTION	RESPONSE TYPE	SUPPLIER/(SUB-) CONTRACTOR RESPONSE	FUTURE PLANS FOR IMPLEMENTING THESE ACTIONS
A	**Environmental Sustainability**			
1.0	*Do you consider the following environmentally conscious purchasing strategies?*			
1.1	Maximize resource efficiency	Yes/No		
1.2	Green purchasing/Green procurement (The process of formally introducing and integrating environmental issues and concerns into the purchasing process is referred to as "green purchasing")	Yes/No		
1.3	Responsible and local sourcing	Yes/No		
2.0	*Does your company have a green supply chain management strategy?*			
2.1	Looking at your suppliers (Tier 1, Tier 2)environmental responsibility and performance (Inbound logistics and procurement, Materials Management, Outbound logistics, Packaging, Reverse logistics)	Yes/No		
3.0	*Do you look at the environmental performance of your company in the projects executed, regarding the following aspects?*			
3.1	Material efficiency-Opportunity for material Reduce, Reuse, Recycle, Remanufacture and Disposal and Dissassembly	Yes/No		
3.2	Opportunity to use second-hand equipment	Yes/No		
3.3	Local environmental impact	Yes/No		
3.4	Environmental considerations made (For example: Environmental efficiency of operating procedures, use of sustainable materials, Biodegradable/compostable (%), Emissions and waste (per unit of product), Pre/post consumer recyclable content (%), Recyclable item (% of total) , Volume of waste sent to landfill, renewable fuels used, use of ozone depleting subtances)	Yes/No		
3.5	Environmental certification (LEED/Ecovadis/CSR)	Yes/No		
3.6	Spill prevention plans (plans+methods of containment for different spills+spill response to different substances)	Yes/No		
3.7	Environmental stewardship (processes and technologies focussing on increased environmental stewardship)	Yes/No		
3.8	Use of conflict minerals (tin, tungsten, tantalum, gold)	Yes/No		
B	**Social sustainability**			
1.0	*Do you give importance to the following employment practices within your company?*			
1.1	Diversity, Equity and Inclusion	Yes/No		
1.2	Corporate code of conduct	Yes/No		
1.3	Employee benefits (such as dialogue with employees, training and education, employment stability, career development, working hours, wages and benefits, security and welfare, privacy)	Yes/No		
2.0	*Do you look at or follow the below mentioned health and safety considerations regarding your employees and community?*			
2.1	Health and safety of employees and community	Yes/No		
2.2	Accident prevention and exposure to harmful materials or process or health risks	Yes/No		
2.3	Safety total case indicent rate (TCIR)	Yes/No		
2.4	Operational facilities are ISO 45001/OHSAS 18001 certificied	Yes/No		
2.5	VCA/ VCA P veiligheidscertificaat	Yes/No		

Figure 5.3 Sample questionnaire format to ask suppliers/(sub-)contractors regarding their sustainability aspects (derived from sustainability framework developed, section 4.5.2-Table 4.6)

The EPC companies can rephrase or restructure the questionnaire format to include those performance indicators they think are crucial in the project or as per client requirements.

5.3 How to incentivize or trigger sustainability from suppliers/(sub-)contractors

The following are recommendations to EPC companies and clients on how they can incentivize, stimulate or trigger sustainability from suppliers and (sub-)contractors:

- *Looking at giving a bonus for sustainability actions in the project*: Considering giving advantages to those SC actors who implement sustainability actions can help trigger sustainability. Similar to how safety is considered where there is a bonus for zero accidents on the project. Interviewee CL1 mentioned "So, if you don't have any carbon emission. Or if you save carbon, there's going to be a reward or something."
- *Freedom to maneuver:* When specifications and requirements are too specific, there is less room for alternate designs to be introduced. Given a bit more freedom to suppliers/(sub-)contractors and EPCs to come with ideas to improve sustainability performance of the project is an effective way to trigger sustainability from them. Interviewee CL3 mentioned "I think if you give more freedom, I think you get a more sustainable creative ideas."
- *Conducting regular audits:* Conducting audits will also help trigger sustainability as actors will understand that sustainability is being measured and evaluated and that it is important for the company.
- *Fictive price discounts:* Providing fictitious discounts on the purchase/tender price, for supply chain actors that have integrated sustainability efforts in their bids can stimulate sustainability as it would give them a concrete advantage in the tendering/bidding process. A discount range of 5-10% could be potentially provided to supplier/(sub-)contractors to stimulate integration of sustainability into their bids.
- *Scoring in technical/commercial bid evaluations*: Give sustainability a scoring in technical or commercial bid evaluations. This can be based on the added value of sustainability in design, operations, etc.
- *Multidisciplinary/cross-functional efforts:* Sustainability needs to be considered as a collective effort within the chain of actors involved in the project. Usually, procurement team procures based on what is designed and engineered. Looking collectively at inputs gathered from procurement, engineering, business development and other related departments within EPCs can help promote better sustainability requirements from SC. Additionally collaborative efforts with clients and SC actors can also further stimulate the integration of sustainable procurement actions in projects.

5.4 Potential takeaways from infrastructure industry

The problem statement (section 1.5) addressed that the infrastructure sector has progressed further in the topic of sustainability than what was observed in the Energy & Chemicals/Process industry. So, it is also interesting to have a brief look at what could be potentially takeaways from infrastructure industry could be translated into the Energy & Chemicals industry.

- *Presence of long-term /maintenance contracts:* In the infrastructure industry, such long-term contracts gives EPCs and contractors opportunities to look at more sustainable materials or equipment or designs, that will save energy, costs, labour during the entire duration of the

projects (20-30 years). Such long-term commitments will also benefit the E&C industry as it would require actors to look at sustainability early on in the project itself with the potential for cost and energy savings during the maintenance phase through reduced maintenance required, reduced labour, lesser operation costs, etc.

- *Early supplier/(sub-)contractor involvement*: In the infrastructure industry, during the design phase itself, contractors are involved. Early contractor involvement gives clients and EPCs the opportunity to understand supply chain capabilities and choose more sustainable alternatives.
- EMVI, BPKV: Aspects like BPKV (Beste prijs kwaliteitverhouding) and EMVI (Economische meest voordelige inschrijving) in the infrastructure industry, where you can score points on sustainability, and use that award criteria to select the best suitable contractor/supplier is also interesting for the E&C industry.
- *MKI:* using calculations such as the MKI (milieukostenindicator- environmental cost indicator) during procurement to evaluate the sustainability aspects of suppliers/contractors, helps identify the environmental effects in one score which can be expressed in euros. This indicator is used as an important criterion for determining the winning tender. Having similar calculations in the E&C industry can also help determine the environmental impact of the supply chain, as well as use it to determine the bid award.
- *Measurement methods:* Using tools like the CO2 prestatieladder to evaluate the CO2 footprint of supply chain actors can also be easily integrated into E&C industry. It is also an easy step to implement, as supply chain actors that are involved with both infrastructure and E&C projects, already have such certificates or tools implemented due to working on infrastructure projects.

At the same time, it is also important to acknowledge that both the infrastructure and the E&C/Process industry function in different contexts. The E&C industry operates in a business environment subject to lesser governance than most infrastructure projects. Thus, it may not be viable that all aspects can be translated from industry to the other. Table 5.2 summarizes the current practices carried out in the Process industry and what could be potentially adopted from the infrastructure industry.

Table 5.2: Summary of potential takeaways from infrastructure industry

	POTENTIAL TAKEAWAYS FROM INFRASTUCTURE INDUSTRY	CURRENT PRACTICES WITHIN ENERGY & CHEMICALS/PROCESS INDUSTRY
1	Presence of long-term contracts with maintenance & operation (long-term vision).	Construction lasts few years with maintenance & operation done by owner/client (short term vision).
2	A lot of sustainability happens in the design phase, which is when early supplier/contractor involvement is welcome.	The Supply Chain is involved usually once FEED package/basic work package is ready. So basic design is already there, less room to maneuver.
3	Legislation/ Governmental requirements present that enforces sustainability be included in projects even if it costs more (EMVI, BPKV) (during scoring of bids, 25% must be allocated to sustainability).	No such legislation.
4	MKI calculations used during procurement for selecting bidders	No such calculations used
5	Measurement instruments such as the CO2 prestatieladder, DuboCalc, Ambitieweb are used to help make sustainability measurement	Such sustainability requirements are not asked commonly from supply chain actors and hence not measured

But at the same time, there are also aspects the infrastructure industry could learn from E&C industry:

- *Less rigid steps*: The current procurement process in the infrastructure is quite rigid and fixed. During procurement, request for bids are sent out, the received bids are evaluated using concepts such as MKI, EMVI, BPKV. Then, the most suitable bid is awarded the work. Unsolicited input provided by supply chain actors is not promoted as it impacts the comparability between the different bids. But by giving contractors/EPCs opportunity to provide unsolicited proposals during/after the bidding phase (proposals with additional aspects not requested by the client), more sustainable and creative ideas can be achieved. This means that contractors can have the freedom to suggest alternate solutions or ideas to the project that are more sustainable and ultimately help in building a better project.
- *Interaction with actors involved in the project chain*: Usually clients in infrastructure projects are mainly involved with SPC's (special purpose companies) or the main EPC contractor. This means that they are less aware of the ambitions and capabilities of suppliers/(sub-)contractors and other actors. Having discussions with supply chain actors playing key roles in the project (mainly Tier 1/direct SC actors) ensures that ambitions and ideas are acknowledge, shared, and discussed.

5.5 Expert evaluation

The goal of expert evaluation is to discuss the main recommendations or solutions proposed with a group of professionals, to see its applicability in practice.

5.5.1 Evaluation approach and expert panel

The expert evaluation approach chosen was to have an online focus group discussion setting, to share feedback and comments on the recommendations and solutions developed. Since the experts were working from different locations, the expert evaluation was conducted initially online through Microsoft Teams, followed by an interactive session using Miro board (online whiteboard tool). Miro was chosen as it provides an interactive platform where each expert can share their views and opinions during the limited time available.

Table 5.3 depicts the four experts including their profiles, who were approached for the expert evaluation session. The experts were chosen based on their involvement in the "Supply Chain Sustainability" group, and their expertise and knowledge in the field of Procurement and Contracts.

Table 5.3: Selection of experts for expert evaluation

No.	Role	Years of experience
1 (EX.1)	Commercial strategies lead Supply Chain	15
2 (EX.2)	Functional Lead Material Management	11.5
3 (EX.3)	Department Manager Supply Chain	10+
4 (EX.4)	Department Manager Material Management	20

The session was structured as follows: First, a brief introduction into the research topic was given including the different phases involved and the main outcomes. The presentation ended with introducing Phase 3: Developing the solution. The experts were then asked to join the Miro link provided. Using the Miro board, feedback was asked on three main topics: (1) the barriers and their mitigation steps proposed, (2) strategy for integrating the sustainability framework into practice and (3) Incentives to trigger or stimulate sustainability from SC. In order to address these points, three main questions were asked:

1. Do you think the following proposed mitigation steps are applicable and useful in overcoming the barriers identified?
2. Do you agree/disagree with the following proposed strategies to integrating the sustainability framework into the procurement practices of an EPC company?
3. Do you think the following aspects can be used to incentivize/trigger sustainability from SC?

Each question and corresponding information were discussed with the experts and then their feedback requested. Additionally, the final prioritized sustainability framework developed (SF.4) and the reasoning behind the mitigation steps for the barriers, were also shared with the experts for their feedback and comments.

5.5.2 Outcome of expert evaluation

[1] Applicability of proposed barrier mitigation steps in practice

Experts were first asked to provide their feedback and thoughts on the proposed mitigation steps thus answering the question “Do you think the following proposed mitigation steps are applicable and useful in overcoming the barriers identified?”

Almost all experts agreed on most of the mitigation steps proposed, except in a few cases. The key areas where experts disagreed or additional feedback was provided, will be discussed below. Appendix D.2a summarizes the findings from the expert session.

- *Role of procurement department (Barrier- Changing project drivers)*

The role of the procurement department in maintaining focus on sustainability even when projects are faced with uncertainties, was mentioned as a mitigation step. Expert 1 agreed to the mitigation step but added that the engineering department should also help the procurement team interpret how green a solution is. Expert 4 agreed and mentioned that all disciplines need to be engaged, including clients.

- *Improving awareness (Barrier- Mindset)*

The importance of creating awareness among all actors involved in the project was mentioned as a possible mitigation step to the barrier. Expert 4 mentioned that it may help having campaigns or portfolios driven from the top management.

- *Setting targets and requirements, Integrating sustainability into bid evaluations (Barrier- Generic requirements)*

EPC companies setting quantifiable sustainable procurement targets and requirements as well as providing a scoring or award criteria for sustainability, was proposed as mitigation steps. Expert 1 mentioned that these aspects need to be agreed with the clients upfront during initial kick-off workshops. Expert 4 mentioned that setting targets is a good step, but it should be made sure that it is actualized, or it could be seen as false reporting.

- *Aligning sustainability goals between the different departments (Barrier-Silos within the organization)*

The need for having organizational ambitions that are jointly agreed by the different departments was proposed as a mitigation step. Expert 1 agreed and mentioned that engineering, procurement, client and contractor need to be aligned in order to drive sustainability and choice of suppliers/(sub-)contractors.

- *Long term relationship management (Barrier- Lack of transparency)*

The need for openness and transparency towards clients and SC was proposed as a mitigation step. Expert 4 added that this should be included in strategic goals and meetings. So, looking at a strategic long-term perspective, and the added value of long-term relationships with clients and SC actors.

Additionally, overall, all experts agreed that these mitigation steps and efforts should be looked at as a multi-disciplinary effort, and not just within procurement.

[2] Viability of the proposed strategies to integrating the sustainability framework into the procurement practices of an EPC company

All experts agreed with the two strategies (plan of action) proposed to integrate the sustainability framework into project procurement practices. They agreed that strategy 1 (the generic format) can be integrated into early project stages such as first contact or solicitation of interest. First contact or solicitation of interest is where the procurement department of EPC companies solicits offers from competing suppliers or (sub-)contractors through an invitation to bid or request for quotations/proposals. While the strategy 2 (detailed sustainability framework) can add value during pre-qualification or bid evaluations to understand sustainability efforts of SC actors.

[3] Applicability of steps to incentivize or trigger sustainability from SC

The experts were asked their opinion on the steps proposed on how sustainability could be incentivized from SC actors. The steps proposed included looking at giving a bonus for sustainability actions in projects, freedom to maneuver, conducting regular audits, fictive discounts and scoring in technical bid evaluations. Different experts had varying opinions regarding the steps proposed. Experts 2 and 3 agreed that all proposed steps would be interesting to use to incentivize or trigger sustainability from SC. Expert 1 mentioned that as sustainability efforts begin with the end client and their requirements, conducting audits and providing scoring for sustainability in technical bid evaluations can have most impact. This will ensure that EPC companies can help clients make informed choices regarding sustainable SC actors. The responses are summarized in Appendix D.2b.

All feedback and comments provided by the expert panel were reviewed and added where applicable, to the recommendations provided to the EPC company. Additionally, the final prioritized sustainability framework developed (section 4.5.2, Table 4.6) was also shared with the expert panel but no additional comments or changes were mentioned.

5.6 Chapter 5- Developing the solution and expert evaluation conclusion and next steps

The main aim of chapter 5 was to develop a strategy on how sustainability could be applied into the procurement practices of an EPC company. Before any strategy can be introduced, the factors hindering its implementation need to be addressed.

To achieve that, the barriers had to be first prioritized to identify the ones having the highest likelihood and severity. Each barrier identified was assigned a likelihood score based on the number of times it was mentioned by interviewees (through ATLAS.ti). Simultaneously a severity score was also assigned based on the impact the barrier can have on the integration of sustainability into project procurement. The likelihood and severity score were multiplied to ascertain the barrier priority score. It was concluded that 'High price/cost' and 'Role of Client/Owner as a barrier', were considered barriers having most impact on sustainable procurement integration. It was followed by "Traditional industry', 'Changing project drivers' and 'Single/Sole source" (summary of barrier priority score shown in Figure 5.4 and elaborated in Appendix D.1). Once the barriers were prioritized mitigation steps were proposed to address each barrier. For example, 'High price/cost' was identified as a barrier with the highest barrier priority score. In order to address this barrier, mitigation steps such as creating awareness regarding long term cost efficiency of sustainable options was suggested. Additionally, looking at sustainability in supply chain logistics and transportation, as well as looking at a Total Cost of Ownership (TCO) perspective were proposed. Similarly, mitigation steps for all barriers identified were proposed.

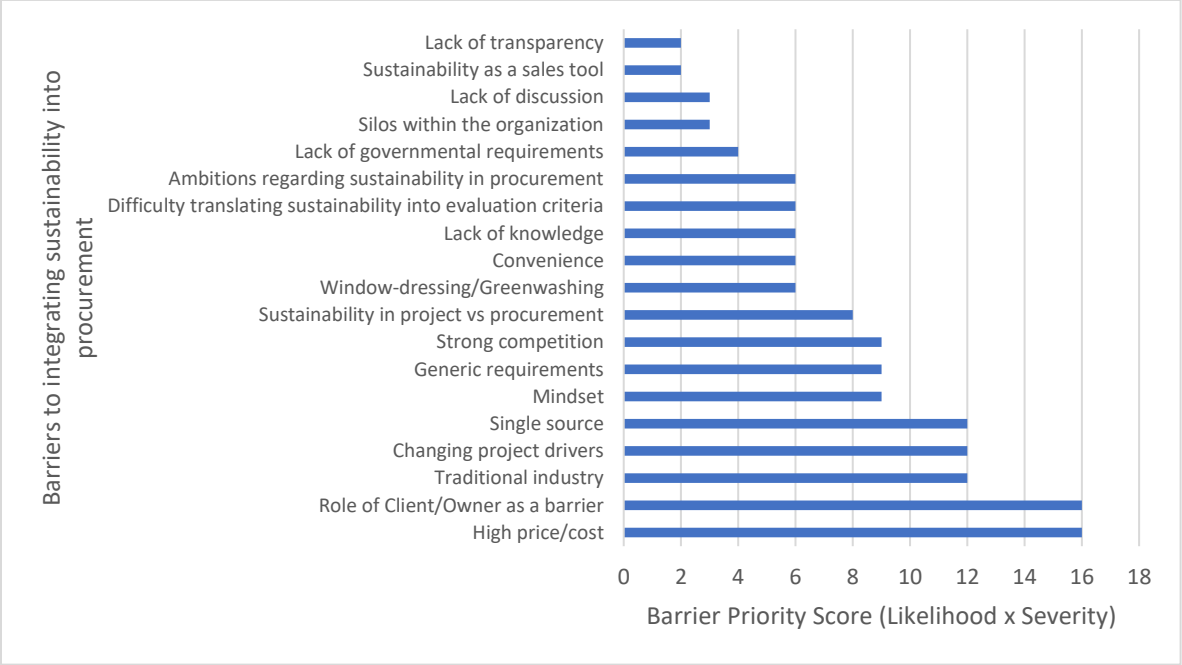

Figure 5.4 Prioritization of barriers using Barrier Priority Score

Once the barriers have been mitigated/addressed, the sustainability framework can be more effectively introduced into practice. Since the focus of this research was integrating sustainability (by adopting the developed sustainability framework) into all/any project phases of an EPC company, a more holistic approach was considered. Different areas within an EPC company's project phases, such as winning the work (project award), defining baseline to execution and project completion were considered. For example, pro-actively mentioning the framework and EPC ambitions to clients to win the work, adding sustainability framework into prequalification's sent to SC actors, evaluating the performance indicators during project completion were a few suggestions made. Since the prequalification phase (selecting SC actors) was identified as having the most impact on achieving sustainable procurement within the company, two strategies or plan of action were proposed. Strategy 1 proposed introducing a generic/inclusive questionnaire initially to gauge SC actor ambitions regarding sustainability followed by the developed sustainability framework. While strategy 2 suggested directly introducing the developed framework into prequalification documents. In both strategies, the framework was introduced in a questionnaire, yes/no format to provide flexibility to the responses while maintaining quality and focus. In addition to introducing the framework into practice, aspects like giving a bonus for sustainability efforts, providing SC actors freedom to maneuver, conducting audits, among others are also suggested as ways to incentivize or trigger sustainability from SC actors.

A brief look was also done into potential takeaways from the infrastructure industry that could be implemented into the E&C industry. For example, using MKI calculations to select bidders and measurement tools such as CO2 prestatieladder.

The steps for developing a solution for EPC companies was followed by expert evaluation. The goal of expert evaluation is to ensure that the strategy or solution proposed is applicable in practice. A panel of four experts with a focus on sustainability within procurement at Fluor were hence chosen. The proposed barrier mitigation steps, the strategy to integrating the framework into the project phases such as prequalification and the possible steps to incentivize/trigger sustainability from SC actors were discussed. Finally, the prioritized sustainability framework developed was also shared to receive feedback and any comments. Their feedback and comments were then analyzed and synthesized into the developed recommendations to the EPC company.

The following chapter will discuss the results obtained so far (Chapter 6-Discussion) and the possible limitations to the research study. This will be followed by conclusions and final recommendations for practice and further research (Chapter 7).

CHAPTER 6

DISCUSSION

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CHAPTER 6: DISCUSSION

This chapter comprises of discussion the research findings (6.1) and addresses the limitations of this research (6.2). The detailed discussion examines the research findings aiming to answer the main research question. This is followed by addressing the limitations identified in this study.

6.1 Discussion of the results

Sustainability has now become a key aspect to be adopted by companies amidst the mounting pressure from the public for more responsible practices, as well as increasing regulations towards responsible behavior (Bai et al., 2015). This research is an exploratory study aiming to develop a strategy or plan of action on how EPC companies in the Energy & Chemicals (E&C)/Process industry, could integrate sustainability into their project procurement practices. This is achieved by developing a sustainability framework tailored to understanding the sustainable capabilities and efforts of supply chain actors (suppliers/(sub-)contractors) in the E&C/Process industry. There is also significantly less literature exploring how sustainable procurement can be carried out by E&C/Process industry EPC companies, thus making this research study novel and beneficial for both academia and practice.

From an academic perspective, this research study develops a sustainability framework that can be potentially integrated into the procurement practices of EPC companies in the E&C/Process industry. Most academic literature reviewed in this study, explores how to assess the sustainability aspects of supply chain actors in different industries such as construction, FMCGs (Fast moving consumer goods), automotive and so on (Bai & Sarkis, 2010; Adetunji et al., 2008; Liczmańska-Kopcewicz et al., 2019; Koplin et al., 2007). While literature looking at assessing the sustainability within the supply chain in the E&C/Process industry were quite limited (Okeke, 2021; Ahmad et al., 2017; Midttun et al., 2007). It was also observed that the literature reviewed focusses more on the environmental dimension of sustainability and less on the social aspects (Seuring & Muller, 2008; Morali & Searcy, 2013; Rentizelas et al., 2020). This lack of research necessitates the need to understand how the E&C/Process industry can operate more sustainably throughout its supply chain. This research study thus addresses this need by qualitatively assessing the sustainability (environmental and social) profile of supply chain actors involved with EPC companies executing oil, gas and petrochemical projects (E&C/Process industry). This is achieved by identifying a set of sustainability criteria focusing on the environmental and social aspects of sustainability, as well as their corresponding performance indicators, relevant to the E&C/Process industry. A qualitative approach is chosen as EPC companies in the oil, gas and petrochemical sector and their SC actors, have only begun to transition towards integrating sustainability into their procurement practices. Thus, using a quantitative sustainability framework during the early stages of this transition may cause supply chain actors without sustainability, to not bid for the projects. Also, in an industry where materials and equipment are single/sole sourced, EPC companies may not have the freedom to disqualify or not award work to supply chain actors scoring low on sustainability. So, a qualitative sustainability framework is best suited to assess the sustainability profile of supply chain actors, as well as gauge their ambitions and efforts regarding sustainability. Additionally, the performance indicators identified in the sustainability framework can also at a later stage be quantified as per industry standards or norms

available. This research study therefore adds to current literature available on how the sustainability aspects of supply chain actors in the E&C/Process industry can be assessed by EPC companies. Ultimately helping to understand the sustainability ambitions, efforts, targets, and goals of supply chain actors involved with E&C/Process industry projects.

But introducing a qualitative sustainability framework into practice also has its challenges. Thus, it is important to identify the enablers and barriers to integrating sustainability into project procurement. By identifying the enablers and barriers, factors that can push or hinder the topic are determined. These help EPCs identify what factors need to be considered or tackled to ensure effective and efficient integration of sustainability into project procurement. In this research study, the enablers and barriers are also considered from a holistic perspective. This means that, enablers and barriers identified by clients, EPC, (sub-)contractors and suppliers were analyzed to understand which aspect each organizational role considers most influential. An overall or holistic perspective was chosen as EPC companies have a central role in the project chain. They work 'for and on behalf' of the client, as well as they directly procure materials/services from supply chain actors. Thus, for EPC companies looking to integrate sustainability into their project procurement, it is of added value to determine what factors are considered enablers and barriers by both clients as well as supply chain actors. This is also an addition to current academic literature that focusses on enablers/barriers identified by individual actors such as clients or suppliers or EPCs, and not from an overall viewpoint. This research study thus explores the enablers and barriers considering all organization roles involved in an EPC project, hence providing a detailed overview rather than focusing on individual actors alone. By focusing holistically, it was observed that price/cost of choosing sustainability and the role of the client/owner were identified by EPCs and supply chain actors as important enablers, while clients identified mindset/culture as a driver for sustainable procurement. Regarding barriers, high price/cost and role of the client/owner as a barrier were commonly mentioned by EPCs and SC actors while clients mentioned high price/cost as a barrier. This ultimately provides an overview on the different organizational role outlook towards sustainable procurement and adds to available academic literature.

A number of studies reviewed in this research study also looks at how sustainable procurement is implemented in the infrastructure industry in the Netherlands (Meehan & Bryde, 2011; Broesterhuizen et al., 2012; Grandia et al., 2014; de Graaf, 2016; van Stiphout, 2018). These studies address the use of innovative contract forms, looking at LCA, the EMVI criterion, the CO2 measurement ladder, Environmental Cost Indicator (MKI-value) and so on to assess, measure and award sustainability actions of supply chain actors. These aspects when found in line with insights gathered during discussions during semi-structured interviews were included as potential takeaways from the infrastructure industry that could be of value to the E&C/Process industry. But this research study adds to this, by also exploring how the context of the E&C/Process industry is different from that of infrastructure sector due to lesser governance, less room for long-term maintenance contracts and so on. This research study also mentions what the infrastructure sector can learn from the E&C industry, thus providing a different viewpoint by looking at it from another perspective.

This research study is also novel as it proposes an action plan or strategy on how EPC companies can tackle the barriers identified and introduce the sustainability framework developed into project procurement. Furthermore, potential takeaways from the infrastructure industry are also addressed to explore what could be adapted from other industries and implemented into an E&C/Process industry. The recommendations provided in this study are also comprehensive as it provides suggestions for all actors

involved in an EPC project procurement process (clients, EPC and SC actors) based on the broad insight gathered. As well as recommendations for infrastructure industry drawn from the brief overview into the industry. These aspects distinguish this research study from reviewed academic literature that focusses on understanding how sustainability can be evaluated or assessed, but not on how EPC companies can adopt them into their day-to-day practices as well as what could be learnt from other industries.

From a practical perspective, the result of this study provides a guideline or strategy for EPC companies in the E&C/Process industry to potentially integrate sustainability into their project procurement practices. Currently, within the industry, there is a lot of focus on achieving sustainability targets from a company or internal perspective. This involves using energy efficient lighting at work, using reusable cups, reducing air travel for employees, reducing scope 1 and 2 emissions, and so on. Within procurement, the focus is also often on indirect procurement (i.e., maintenance, goods and services required for a company's day to day operations like furniture, utilities, stationary). Although focusing on sustainability from an organizational perspective is equally important, it is also necessary to understand how sustainable ambitions can be implemented at the project level. This research study suggests a plan of action for achieving this, by exploring how sustainability can be integrated into project procurement practices of EPC companies in the E&C/Process industry. The beginning of any solution depends on understanding and addressing the barriers that are hindering its implementation. The mitigation steps propose recommendations on how the barriers could be addressed. Once the barriers have been addressed, EPC companies can more efficiently introduce sustainability either through the sustainability framework or other requirements into their project procurement practices. Since the focus of this research study was looking into all project phases, suggestions on how sustainability could be integrated into the different project phases are studied. This will provide an understanding on how integrating sustainability in different project phases can have different impacts. Since the focus of this study is on procurement, the most effective step to add the sustainability framework is into supplier/(sub-)contractor prequalification or selection. This is where EPC companies decide on the SC actors, they would choose for carrying out necessary works in the project. Adding sustainability into prequals can add most impact as you identify SC actors with sustainable capabilities or ambitions and by selecting them, improve sustainability within the project and its procurement. This is also different from other literature references studied, where a guideline or roadmap is not discussed to help EPC companies in the E&C/Process industry understand how they can implement sustainability in their procurement practices. The academic papers reviewed look more into how the sustainability performance of supply chain actors in the E&C/Process industry can be assessed (Ekiugbo & Papanagnou, 2017; Nguyen Hoai & Ramirez D'Avanzo, 2011; Olugu et al., 2022) and not on how sustainable procurement can be applied in day-to-day practices of an EPC company. Furthermore, understanding how other sectors such as infrastructure integrate sustainability into their procurement practices provides a brief overview for EPC actors in E&C/Process industry on how other industries are approaching the topic of sustainable project procurement.

6.2 Limitations of this research

This section discusses the limitations of the research study. The limitations are as follows:

- The research was focused on developing a sustainability framework from a qualitative perspective as a first step to integrating sustainability into project procurement practices of an EPC company.

Thus, no standards or quantitative measurement methods were studied to evaluate the performance indicators identified. This will have the limitation of not being able to quantitatively measure the sustainability performance of SC actors.

- The validation of the recommendations was only done by practitioners within the case company (FCBV). If the validation of the recommendations and strategy had also included the end Client and SC actors, it would have given the end solution a stronger and more holistic stand.
- The solution proposed was based on the procurement practices of the case company studied. Hence, the procurement practices may vary across other EPC companies in the E&C industry. This may thus influence how the sustainability framework could be integrated into a company's project procurement practices.
- The sustainability framework developed from document review was based on sustainability criteria and performance indicators identified from the case company documents. Other EPC companies may have additional sustainability criteria and performance indicators that were not considered in this framework. The framework thus may not encompass all the criteria and performance indicators identified by different EPCs in the industry.
- The focus of this study and the sustainability framework developed was on the environmental and social aspects of sustainability (as per the Triple Bottom Line concept). Economic sustainability and its corresponding criteria and performance indicators were not further explored as it was observed that most of them were already considered by the EPC case company and hence removed from the final framework.

CHAPTER 7

CONCLUSIONS

&

RECOMMENDATIONS

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CHAPTER 7: CONCLUSIONS & RECOMMENDATIONS

The main objective of this research study was to develop a strategy on how sustainability could be integrated into the project procurement practices of an EPC company. This chapter presents the final conclusions of the research study. By answering the main research question, the findings from each phase of the study are explained by answering the related sub-questions (7.1). Subsequently, the main research question is answered (7.2). This is followed by recommendations to both practice and science (7.3).

7.1 Answering the research sub-questions

SQ1: What are the characteristics of EPC companies within the Energy & Chemicals (E&C)/Process industry?

This sub-question was part of phase one of this research study and was answered from both a literature and practical perspective. From literature review, the attributes of EPC companies in the E&C industry was understood by exploring the different project delivery methods used, the contract types available and aspects of a typical project lifecycle and procurement process. Similarly, from document review, the attributes of the case EPC company (FCBV) were also studied to understand how their characteristics compare with the insight gained from literature. For the case company FCBV, the attributes identified included the use of EPCM project delivery method in the Netherlands. Additionally, it was observed that preferred upstream contracts are cost reimbursable and lumpsum, while commonly used downstream contracts are unit price contracts. This was followed by understanding how procurement is carried out at FCBV by dividing the process into Material Management (MM-procuring of materials/equipment from suppliers/vendors) and Contract Management (CM-procuring of services from (sub-)contractors).

SQ2: How can EPC companies assess the sustainability level of their suppliers/(sub-) contractors?

In order to answer this research sub-question, first the concept of sustainability to be used in this study was identified. The Triple Bottom Line (TBL) was chosen due to the equal importance given to the environmental, social and economic aspects of sustainability. This was followed by conducting an extensive literature review on the various sustainability criteria and performance indicators to assess the sustainability level of SC actors (Chapter 2). This literature review resulted in a conceptual sustainability framework consisting of 13 environmental criteria and 83 corresponding performance indicators, 8 social criteria and 37 corresponding performance indicators and 10 economic criteria and 73 corresponding performance indicators. Similarly, a document review (case company) was done to identify sustainability criteria and performance indicators mentioned in the case company documents (Chapter 3). A total of 12 environmental criteria and 71 performance indicators, 8 social criteria and 36 performance indicators and 7 economic criteria and 42 performance indicators were identified. The frameworks developed from

literature and document review when combined and synthesized results in the main conceptual framework, focusing on environmental and social aspects of sustainability. It had 12 environmental criteria and 33 performance indicators and 9 social criteria and 22 performance indicators.

SQ3: What enablers and barriers are encountered by EPC companies in integrating sustainability into their procurement practices?

The enablers and barriers to integrating sustainability into procurement were identified in phase two (Chapter 4) of this research study. From semi-structured interviews, 14 enablers were identified that could support the integration of sustainability into project procurement. They were: price/cost as an enabler, role of client/owner as an enabler, mindset/culture as a driver, governments/legislation, collaboration and continuous dialogue, transparency, long term vision/strategy, market and stakeholder requirements, current energy/gas prices, creating awareness, setting requirements for sustainability, long term relations, company initiative and price advantage. Among those, price/cost and role of client/owner were most frequently mentioned enablers during interviews. This was followed by identifying the barriers encountered by EPC companies in integrating sustainability into project procurement. These included: high price/cost, role of client/owner as a barrier, traditional industry, mindset, changing project drivers, single source, generic requirements, window-dressing/greenwashing, strong competition, convenience, lack of knowledge, difficulty translating sustainability into evaluation criteria, ambitions regarding sustainability in procurement, sustainability in project vs procurement, lack of governmental requirements, silos within the organization, sustainability as a sales tool, lack of transparency and lack of discussion. Among the barriers identified, clients mentioned high price/cost, traditional industry and mindset as significant barriers. While EPC (Fluor) and SC actors identified high price/cost and role of client/owner as significant barriers to sustainable procurement.

SQ4: How can the performance indicators be prioritized to add most impact when integrated into procurement?

In order to answer this research sub-question, the conceptual framework developed in Chapter 3 (section 3.3, Table 3.2) was introduced during the interviews. The interviewees were asked to prioritize the performance indicators based on their expertise and preference. They were asked to rank each performance indicator according to what they felt was extremely important to know during procurement, important to know and good to know. Any additional indicators they felt relevant to the framework were also addressed. The conceptual framework was prioritized and adjusted as per interviewee prioritization. This provides a list of key performance indicators for each sustainability criteria based on what interviewees mention are important to sustainable procurement. The sustainability framework developed as a result of this prioritizations, is the final version of the framework developed to be applied in practice. This prioritized version of the sustainability framework was also shared with the expert panel during expert evaluation to gather their feedback and comments.

Table 7.1: Final sustainability framework (after prioritization and expert evaluation) to be applied in practice

TBL aspect	Criteria	Performance indicators
ENVIRONMENTAL	**Environmentally conscious purchasing (E1)**	Maximize resource efficiency (E1.1)
		Green purchasing/Green procurement (E1.2)
		Responsible and local sourcing (E1.3)
	Green Supply Chain Management (E2)	Suppliers (Tier 1, Tier 2) environmental responsibility and performance (Inbound logistics and procurement, Materials Management, Outbound logistics, Packaging, Reverse logistics) (E2.1)
	Environmental performance (E3)	Material efficiency-Opportunity for material Reduce, Reuse, Recycle, Remanufacture and Disposal and Disassembly (E3.1)
		Opportunity to use second-hand equipment (E3.2)
		Local environmental impact (E3.3)
		Environmental considerations made (Environmental efficiency of operating procedures, use of sustainable materials, Biodegradable/compostable (%), Emissions and waste (per unit of product), Pre/post-consumer recyclable content (%), Recyclable item (% of total), Volume of waste sent to landfill, renewable fuels used, use of ozone depleting substances) (E3.4)
		Environmental certification (LEED/Ecovadis/CSR) (E3.5)
		Spill prevention plans (plans+methods of containment for different spills/spill response to different substances) (E3.6)
		Environmental stewardship (processes and technologies focusing on increased environmental stewardship) (E3.7)
		Use of conflict minerals (tin, tungsten, tantalum, gold) (E3.8)
	Pollution Control and Waste Management (E4)	Waste reduction strategies: (1) Can waste be recycled rather than sent to a landfill? 2) Can disposal in landfills or incinerators be minimized? 3) Can unused materials be returned to suppliers? 4) Can equipment packaging be returned to suppliers? 5) Can environmentally preferred products (ones that are easier on the environment) be used?) (E4.1)
		Site waste management plan (Including Waste minimization plans such as (E4.2): (1) Eliminating equipment pieces or connections where possible 2)Modifying or replacing standard equipment pieces, for example, using seal-less pumps 3)Using design practices that provide early detection of losses (e.g., aboveground tanks and piping) 4) capture and recycle to prevent or minimize waste generation 5) carry out 'process stream inventory" to consider streams with potential to generate waste)
		Pollution Control (pollution factors constituted from the supplier production and service processes and product components. Related with air emissions, wastewater, spills noise, soil, odor and solid wastes) (E4.3)
	Management of hazardous substances (E5)	Hazardous substances management (requirements facilitating safe handling, use, storage and disposal of hazardous chemicals/materials/substances) (E5.1)
		Design of products to avoid or reduce use of hazardous products and their manufacturing process (E5.2)
		Regulations on use of hazardous substances (E5.3)
		Hazardous air emissions (CFC's, EtO, MEK, Toluene, etc.) (E5.4)

TBL aspect	Criteria	Performance indicators
ENVIRONMENTAL	**Life cycle Assessment (E6)**	Life Cycle Analysis (E6.1)
		Life Cycle Costs, Net Life Cycle Costs (E6.2)
	Environmental regulations/ Environmental compliance (E7)	Environment related certificates (ISO 14000/ISO 14001/ EMAS/ AS NZS ISO 14001) (E7.1)
		Environmental compliance with environmental laws and regulations (also local regulations such as having CO2 scrubbers or denox installations for exhaust emissions) (E7.2)
	Environmental Management Systems (EMS) (E8)	EMS Program Development, Implementation, and Evaluation (E8.1) - Pollution Prevention and Waste Minimization Programs - Sustainability Programs - Energy Efficiency Programs - Air, Water, and Soil Monitoring - Permit and Consent Coordination - Air Dispersion Modeling - Environmental Impact Assessment - Spill Prevention/Control Countermeasure Planning - Environmental Audit/Assessments - Waste Disposal Planning
		Existing environmental management systems (E8.2)
	Energy efficiency (E9)	Reduction in energy consumption (both direct (natural gas, diesel, gasoline) and indirect energy use (for electricity)) (E9.1)
		Use of renewable energy (E9.2)
		Amount of energy and efficiency required for the products manufacture and assembly (amount of energy used per unit of product) (E9.3)
	GHG emissions/Carbon footprint/ Carbon management (E10)	Carbon reduction in project execution, operations, and maintenance (E10.1)
		Reduction and evaluation of CO2 emissions and CO2 footprint (e.g.: Co2 prestatieladder) (E10.2)
		Carbon reduction targets in project execution, operations, and maintenance (E10.3)
	Product stewardship (E11)	Design for the environment (E11.1)
	Green competencies (E12)	The type of materials making up the supplied component (E12.1)
		Availability of clean technologies (E12.2)

TBL aspect	Criteria	Performance indicators
SOCIAL	**Employment practices (S1)**	Diversity, Equity and Inclusion (S1.1)
		Corporate code of conduct (S1.2)
		Employee benefits (such as dialogue with employees, training and education, employment stability, career development, working hours, wages and benefits, security and welfare, privacy, PayOK certificaat) (S1.3)
	Health and safety (S2)	Health and safety of employees and community (S2.1)
		Accident prevention and exposure to harmful materials or process or health risks (S2.2)
		Safety total case incident rate (TCIR) (S2.3)
		Operational facilities are ISO 45001/ OHSAS 18001 certified (S2.4)
		VCA (Veiligheid, Gezondheid en Milieu Checklist Aannemers)/ VCA P veiligheidscertifcaat (S2.5)

TBL aspect	Criteria	Performance indicators
SOCIAL	**Local Community Influence (S3)**	Skills enhancement of local workforce (S3.1)
		Community dialogue and engagement (S3.2)
		Investment in local community and community involvement (S3.3)
		Diverse and local suppliers (S3.4)
	Stakeholder's influence (S4)	Stakeholder relations and participation (S4.1)
		Information provision (S4.2)
	Company efforts (S5)	Social responsibility efforts (S5.1)
		Training and programs for employees for green consciousness (S5.2)
		Environmental image of company (S5.3)
	Discrimination (S6)	Discrimination in employment (age, religion, gender, and other similar factors) (S6.1)
		Racial or sexual discrimination and harassment (S6.2)
	Child labor and rights (S7)	Measures to prevent or eradicate child or forced labor (S7.1)
	Employee and stakeholder rights (S8)	External stakeholder human rights (e.g., local communities, civil society) (S8.1)
		Rights of indigenous people (S8.2)
	Contribution to society (S9)	Tools and resources to support community building, charity, volunteering (S9.1)

SQ5: How can the sustainability framework developed be applied in practice?

In phase three, chapter 5, this research sub-question was answered by developing a solution/strategy on how sustainability can be integrated into an EPC company's project procurement practice. First the barriers identified in the previous chapter (Chapter 4) were prioritized based on their likelihood of occurrence and severity. Once each barrier was given a barrier priority score and prioritized, mitigation steps were proposed to address the barriers. Mitigating the barriers were considered as the first step because once the barriers hindering implementation of sustainability into procurement are addressed, the sustainability framework can be more efficiently and effectively integrated into practice. Potential areas of integration such as in prequalification, proposals, supplier questionnaires, evaluation, etc. were explored to understand the areas where the framework could be implemented, along all/any project phases. As prequalification has the potential to create most impact in selecting and profiling supply chain actors, sample strategies on integrating the framework were discussed. Once the framework has been integrated into project procurement practices, sustainability can be further pushed through incentivizing or triggering SC actors. This can be done through price advantages, including evaluation criteria and so on. Thus, a complete strategy is proposed on how EPC companies can introduce sustainability into their project procurement practices and follow through.

7.2 Answering the main research question

Having answered and gained insight from the sub-questions, the main research question defined for this research can be answered as follows:

How can sustainability be integrated into the procurement practices implemented across all project phases of an EPC company?

The overarching aim of this research study was to develop a strategy or plan of action that can be followed by EPC companies in the E&C/Process industry, in order to integrate sustainability into their project procurement practices. Currently, it was observed that sustainability was included in procurement either as a generic question, as part of HSE or as per client requirements. To help EPC companies pro-actively adopt sustainability into their project procurement, the main hurdle faced by them, "What do we ask from our SC actors?", had to be addressed. This was tackled by developing a holistic sustainability framework with sustainability criteria and performance indicators to ask and gauge the sustainability level of SC actors. But integrating a framework into practice will not be successful unless the barriers preventing its implementation are tackled. Thus, the barriers hindering its implementation were addressed by proposing mitigation steps. Once the barriers are addressed, the sustainability framework can be effectively introduced into any/all project phases. Such as wining the work (mention pro-actively to clients about the framework and EPC company efforts), defining to execution (include framework into prequalification, selection practices) and completion (evaluate if SC actors performance match what they mentioned in prequals). To further push the topic of sustainability from SC actors measures to incentivize or trigger sustainability actions from SC actors can also be considered. Together, all these measures create a strategy on how sustainability can be efficiently and effectively be integrated into project procurement practices of an EPC company in the E&C industry.

7.3 Recommendations for practice

Tackling the barriers and introducing the sustainability framework into procurement is the main strategy towards integrating sustainability into procurement studied and explored in this research study. Below sections describes additional recommendations to all actors involved in the project chain (Clients, EPCs and Supply chain (SC-suppliers/(sub-)contractors) on how they can improve or better integrate sustainability into procurement.

7.3.1 Recommendations to EPC company

Chapter 5 can be viewed as focusing on recommendations to EPC companies on integrating sustainability into project procurement. The barrier mitigation steps proposed (section 5.1.2), the strategy for integration suggestion (section 5.2) and potential ideas to incentivize or stimulate sustainability from SC actors (section 5.3) can all be seen as recommendations to EPC companies.

Additionally, few other recommendations suggested include:

- ***Introduce sustainability into technical/commercial bid evaluations*:** Introducing sustainability into bid evaluations can be done by first developing a questionnaire to be sent out to supply chain actors. The questionnaire can include topics regarding their sourcing practices, their environmental and social responsibility efforts and so on. This will help EPC companies understand SC actor capabilities and ambitions more and ultimately help better integrate sustainability into project procurement. Additionally, it is also of value to see how wordings or clauses can be incorporated into Pos (Purchase Orders) and contracts.
- ***Collaborate with clients to integrate sustainability into procurement*:** In the E&C industry, clients play a major role on how sustainability is integrated into projects. But they may not always be aware of the latest technologies or sustainable SC actors available in the market. EPC companies can provide their expertise and suggest sustainable alternatives or methods to integrate into project procurement. Thus, more collaboration and early discussions involving clients are important for integrating sustainable procurement strategies into projects.
- ***Set clear ambitions and targets***: When EPCs mention their sustainability ambitions and targets to clients, it should not be generic as this causes uncertainty and confusion. The additional efforts taken for sustainability and the added value should be clearly communicated to the client. Proactively mentioning the aspects (costs/benefits/etc.), associated with sustainable procurement will give clients a tangible understanding of the advantages associated with integrating sustainability into procurement.
- ***Explore possibilities within the industry***: Look at sustainable possibilities within the industry in terms of selling back unused material, using secondhand equipment etc. A market survey could be conducted to see the possibilities available regarding sustainability in the industry.
- ***Trigger ambition among SC actors***: Even if SC actors don't have sustainability certificates or goals at the moment, they should still be given the opportunity to improve and provide such targets during the project lifetime, if they want to be awarded the project. This will also help SC actors develop sustainability goals and ambitions within their organization.
- ***Be pro-active:*** EPCs need to be more pro-active in their approach towards sustainability. They should not only focus on client requirements or change within the whole industry before adopting more sustainable measures into procurement. EPCs should approach sustainability from their own mindset and ambition to improve their environmental and social responsibility. This can be done by proactively integrating sustainability into discussions with clients and SC actors. EPC companies can also integrate their sustainability goals and targets, how it could be achieved and the impact it can have on the project into project proposals even if unsolicited by the client (i.e., not specifically required by the client).
- ***Early involvement of SC actors***: Early collaboration and discussion with SC actors can help develop a culture of knowledge sharing. This can ultimately help identify more sustainable alternatives available in the industry and help expand the company's sustainability goals across the SC. This will also help SC actors understand the importance given to sustainability alongside other commercial and technical criteria and convey the EPC company's sustainability commitment.
- ***Multidisciplinary action/cross functional integration***: Usually in E&C projects, the engineering of a design/plant is completed and then shared with the procurement team for acquiring of

materials/services. But by having the procurement team involved early on with engineering, they could suggest sustainable alternatives based on their knowledge of SC actor capabilities and market availabilities. This also helps develop a culture of multidisciplinary collaboration within the organization to achieve the best sustainable results for the projects executed.

- ***Flexibility in approach***: Typically, traditional procurement involves having a detailed design or basic package available and then sharing those specific requirements with SC actors. But it would be interesting if EPCs could share a general outline of what they want to achieve with SC actors, who can give their thoughts, and based on that shortlist three main promising ideas (provided they are technically and commercially suitable). Further selections and evaluation can then be done with these SC actors.
- ***Involvement from top management/Top management support***: For any step towards sustainability in procurement to happen within an organization, the top management should set down clear requirements, goals and ambitions that needs to be flowed down to the project team within EPCs. This is also the fastest way to ensure that sustainable procurement is given a priority in every project within an EPC company.
- ***"Sustainability topic/Sustainability pitch"***: Currently most company presentations and discussions begin with a safety topic. A similar step can also be taken for sustainability. Introducing a sustainability pitch/sustainability topic to meeting discussion will show clients and members within the EPC company, the sustainability ambitions, and goals the company has. As well as the actions that are or could be taken to achieve those ambitions.
- ***Explore sustainability options in polluting materials like steel*****:** Steel is considered one of the biggest pollutants in the industry, and within E&C it is mentioned that there are not many options to recycle or reuse steel as it still needs to meet quality and safety specifications. But options like using modular construction methods, using slotted steel (so required less material and less labour for assembly and disassembly), using bolted connections rather than welded connections for easy dismantling are all cost-efficient ways in which steel construction can be made more sustainable. Additionally, there are also green steel options available in the market that can be considered as sustainable alternatives (but a market study needs to be made).

Among the recommendations provided for EPC companies, a few can be considered as easy 'first steps' that can be taken to start the movement towards integrating sustainability into procurement. Towards clients, a potential first step EPCs could take could be the addition of a 'sustainability topic/sustainability pitch' to discussions with clients hence promoting ambitions and possibilities within EPCs regarding sustainable procurement. During these 'topic/pitch' discussions, EPC companies can show clients alternate material or construction methods that are more sustainable. For example: using modular fabrication and construction methods to improve resource efficiency and reduce labor could be discussed, potential of sourcing locally, etc. These discussions can also help identify opportunities to replace or reimagine traditional activities with more sustainable alternatives. Clients can further explore these possibilities through discussions with SC actors and EPCs, hence promoting more sustainable actions.

Within the EPC organization itself, a potential first step towards sustainable procurement is having top management strengthen and align internal goals and performance management structures to support achievement of sustainability objectives. This can be through setting ambition levels to be achieved (e.g., if level 1 involves minimizing waste, then waste minimization strategies in projects need to be explored.

The sustainability criteria and performance indicators relating to this ambition level can also be used from the framework developed).This will also be flowed down to the various departments (including procurement) and can help promote the topic further. An EPC company's top management can also help set realistic timelines for achieving sustainable procurement goals. Another step is having inter-departmental discussions to see how other departments like engineering can also help support procurement. For example, if the engineering department can suggest a more efficient design that reduces amount of material/equipment required or suggests sustainable alternatives, the procurement department can procure accordingly. Additionally, supply chain actors involved with the E&C industry sometimes also execute infrastructure projects. It could be an easy first step for EPCs to ask them for sustainability measurement aspects like the CO2 prestatieladder, energy efficiency calculations, etc. as the SC actors may already have them.

Towards SC actors, as a first step EPC companies can invite SC actors for an open discussion to discuss possibilities to integrate sustainability into the project. Being more transparent towards how sustainability will be scored during the SC actor selection process and the EPC company's ambitions towards the topic can also have added value.

Overall, sustainable procurement is a topic that can be leveraged through collaboration and information/knowledge sharing among all the actors involved in a project (client, EPC and suppliers/ (sub-) contractors). There is 'no-one-size-fits-all' in sustainable procurement, thus engaging all actors is an important step towards ensuring sustainability is effectively integrated into project procurement.

7.3.2 Recommendations to clients

The following recommendations to the clients in the **Energy & Chemicals** industry include:

- ***Sustainability in RFP's and RFQ's*:** It would be beneficial to include a section in your RFQs (Request for Quotations from suppliers) or RFPs (Request for Proposals from contractors), what as a supplier/contractor they are going to do to make this project more sustainable.
- ***Freedom to maneuver***: Give EPCs and SC actors the opportunity to provide innovative ideas for designs for your project. Having specific and fixed requirements gives less freedom to EPCs and SC to bring sustainability into the project.
- ***Progress meetings and discussions***: Conduct monthly 'sustainability progress meetings' (similar to safety meetings), where sustainability efforts of EPCs/suppliers/(sub-)contractors are checked and how sustainability could be better implemented in the project is discussed. Also, discuss with EPCs, suppliers and (sub-)contractors what are the possibilities for sustainability within the limits of the project (in terms of budget, time, schedule).
- ***Budget for sustainability*:** Set aside a budget for looking at sustainability within projects. This will ensure that even if a supplier/(sub-)contractors bid is slightly more expensive but more sustainable, it can still be awarded the project.

The following recommendations are also provided to the **Infrastructure** industry (as it was also looked at briefly in this study):

- ***Focus beyond MKI (milieu kosten indicateurs*):** The MKI is a great way to ensure sustainability is considered in projects, but that should not be the only aspect considered. By focusing on the requirements mentioned in the MKI alone, the potential to ask suppliers/(sub-)contractors if they have any ideas or alternatives on making the project or design more sustainable is not considered. Thus, setting higher ambitions and goals in the contracts to stimulate sustainability from EPCs and contractors need to be considered.
- ***Need for collaboration***: There needs to be more discussion and collaboration between the actors involved in the project chain (subcontractor-EPC-client) to ensure capabilities and opportunities regarding sustainability are identified and addressed.
- ***Openness towards more unsolicited proposals***: Clients should also welcome unsolicited suggestions or proposals during and after the bidding phase, from EPCs and SC actors on how they can improve sustainability in the project.

7.3.3 Recommendations to Supply Chain (SC-suppliers & (sub-)contractors)

The following are recommendations to the supply chain actors:

- ***Be pro-active about sustainability*:** Instead of considering sustainability only when requested by clients, it is beneficial for SC actors to be pro-active and develop sustainable alternatives and pitch them to clients/EPCs. This would give them a better market advantage in the long run and also convey to clients and EPCs their ambitions regarding sustainability.
- ***Describe ambitions clearly:*** The sustainability ambitions and targets within the SC organization should be communicated clearly to clients/EPCs. Also, any specific plans or targets relating to sustainability that is currently in place, with regards to the individual projects as well as the company as a whole should be described clearly.
- ***Be clear and transparent*:** It is of added value to be clear and transparent to clients and EPCs about the possibilities for sustainability in the project and the added costs involved in it.

7.4 Recommendations for further research

In addition to the recommendations for practice, recommendations for further scientific research are given below:

- This research study was focused on developing a qualitative framework for integrating sustainability into project procurement practices. A next step could be exploring how the performance indicators identified in the framework can be quantified (into KPI's) and which measurement methods/tools/standards/norms can be identified. This can be done by developing a benchmarking took or a quantitative framework. This will add value to both academia as well as practice.
- Further research can be done to adapt and apply the sustainability framework developed across other industries and organizational levels (clients/suppliers/(sub-) contractors).

- The effect of multidisciplinary/cross functional team discussions and collaborations in improving the integration of sustainability into project procurement can also be further explored.
- Looking into the influence of different contract types in the E&C/Process industry to encourage and stimulate sustainable procurement strategies is also an interesting topic to research further.

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APPENDICES

APPENDIX A: LITERATURE REVIEW (Chapter 2)

Appendix A.1: Procedure for conducting literature review

The following section describes the steps taken to find the relevant literature from various sources available to ultimately answer the sub-questions framed in this research study.

Fink (2014) describes literature study as a structured procedure used for assessing, reviewing and consolidating the academic works that have been documented by academics and researchers previously. The procedure suggested by Fink (2014) and followed in this study consists of the following steps:

1. **Selecting research questions**

The first step for every research study is by formulating the research questions. The research questions used in this study have been discussed in Section 1.8, along with the goal and reasoning supporting the research questions.

2. **Selecting bibliographic or article databases**

A bibliographic or article database is a source where different published literature, articles, academic sources, papers, etc. are compiled. Through the database, the researcher is able to collect data that helps answer the research questions developed. In this research study the following online databases were used:

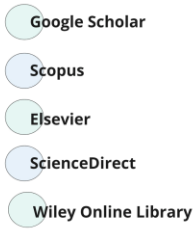


Figure A.1 List of databases used in research

3. **Determining specific keywords**

Keywords are terms that are used to find academic literature from the database. The keywords are selected based on their relevance in helping answer the sub-questions. In this research study, to sub-questions (SQ1 and SQ2), were answered from literature study.

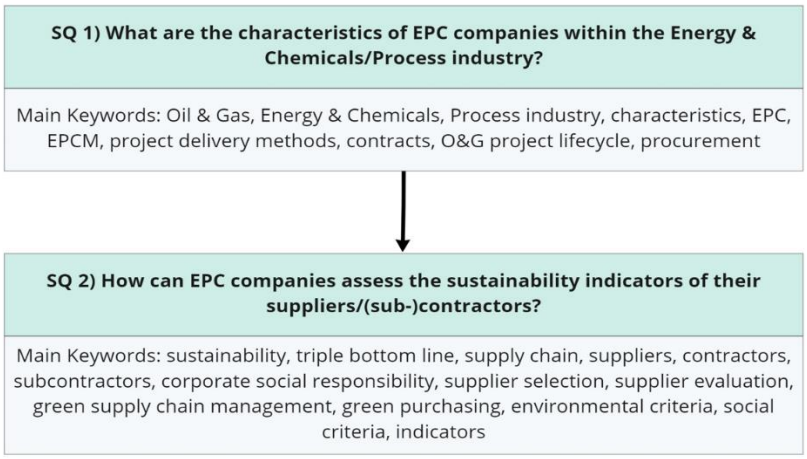


Figure A.2 Main keywords identified to answer sub-questions

4. Applying pragmatic screening criteria

The next step in the literature review is to set certain pragmatic parameters to screen the numerous articles found from the database. The goal of the parameters is to ensure that only relevant literature is used in the study. The parameters set were mainly regarding the sector of the study and the phase of the project. The oil & gas/process/manufacturing sector or the infrastructure sector was given priority. The focus was also downstream towards supply chain (suppliers/(sub-)contractors) and assessing their sustainability criteria. Additionally, only the project perspective was looked at and not sustainability aspects within the office (eg: using reusable cups/differentiating paper and plastic waste at the office etc).

5. Applying methodological screening data

Methodological screening data includes the criteria for evaluating the scientific quality. To ensure quality was maintained, literary work that has been cited only 3 times or less, were excluded from the literature review. This was because, the researcher expected these works to not yield significant information and insight as it had been cited by so few other researchers.

6. Doing the review

Once the keywords and screening parameters are applied, the identified literature is then reviewed to answer the sub-questions developed.

7. Synthesizing the results

This step related to understanding the information retrieved from the various literature study, analyzing and synthesizing the information to address the different aspects of the sub-questions in detail. The findings from the literature review is elaborated in detail in Chapter 2.

APPENDIX B: DOCUMENT REVIEW (Chapter 3)

Appendix B.1: Procedure for conducting document review

The following section describes the steps taken to find the relevant information from Fluor (internal) company documents relating to sustainability, thus adding to the insight gathered from literature and ultimately answering the sub-questions framed in this research study.

The steps suggested by Fink (2014) is also used for assessing, reviewing and consolidating the documents present at the case company. It includes the following steps:

1. **Selecting research questions**

The goal of the document review is to answer the sub questions SQ1 and SQ2 from the case company perspective. This helps understand the characteristics of an EPC company like FCBV and adds to the conceptual sustainability framework developed, to assess the sustainability aspects of suppliers/(sub-)contractors.

2. **Selecting databases**

Within Fluor, the main database where all information regarding the various practices, guidelines, forms etc. is consolidated is called "*Knowledge Online*". This is also considered the main database for gathering the necessary information needed to develop the framework. Additionally, Fluor internal training documents provided are also used for guidance and reference.

3. **Determining specific keywords**

The keywords were selected based on the data that was to be obtained from the documents. Since the focus was on identifying sustainability related documents, the keyword "sustainability" alone was used and all documents relating to sustainability was reviewed.

4. **Applying pragmatic and methodological screening criteria**

In order to screen the numerous documents found, a few screening parameters were used.

- All archived or superseded documents were removed from document review, as they were not currently being used by the company.
- Only the latest versions of the retrieved documents were used to avoid any incorrect or outdated information being collected.

5. **Doing the review**

Once the keywords and screening parameters are applied, the identified documents are reviewed to answer the sub-questions developed.

6. **Synthesizing the results**

This step related to understanding the information retrieved from the various company documents, analyzing and synthesizing the information to address the different aspects of the sub-questions in detail. The findings from the document review are elaborated in detail in Chapter 3.

APPENDIX B.2: Summary of case company documents reviewed (anonymized)

#	Document description
	Fluor office & corporate documents
FD1	- This document gives a brief overview on general sustainability aspects, as well as those that could be integrated into supply chain. - These include Scope 1, 2, 3 emissions, use of EcoVadis CSR certification, etc.
FD2	- This reporting standards document describes the framework in which Fluor details its impact on economy, environment, and society in line with GRI (Global reporting Initiative) structure
FD3	- This internal Fluor office document reflects on the sustainability efforts in project execution in 2021, as well as mentions future goals for 2022 and 2025.
FD4	- This document discusses the proposed sustainability focus areas for Fluor including Company purpose and values, Disclosure reporting and transparency, Customers and Markets, Environmental footprint-operations, Supply Chain-Environmental Impacts and Own operations-workplace.
FD5	- This document discusses the sustainability mission of Fluor and how Fluor together with the clients, can help achieve their sustainability ambitions.
FD6	- The purpose of this general document is to mention the importance of project processes for a sustainable company.
FD7	- The purpose of this sustainability report is to discuss the topics of governance and leadership, strategy and execution, environmental stewardship, and social responsibility within Fluor.
FD8	- This document is an overview of a Fluor tool which can be used to manage sustainability indicators for Fluor office facilities and project sites globally. - The areas of focus mentioned include energy usage, water usage, waste production/recycling and community relations.
FD9 (000.100)	- This guideline document (000.100) establishes the preferred method of implementing a Value Improving Practice (VIP) Program on a project. Value Improving Practice tools and methodologies are employed on a project to improve the return on a client's capital investment by optimizing facility revenues, reducing operating expenditures and minimizing capital expenditures. - It mentions several VIPs such as sustainability, life cycle analysis, waste minimization, value engineering, etc.
FD10	- This document is a brief overview on the key sustainability aspects focused on by Fluor such as their sustainability mission, the tools present, their commitment to help the energy transition and to achieve net zero by 2023.
FD11	- This document describes Fluor's goals to be Net Zero by 2023, by means of eliminating operational Scope 1 and 2 absolute GHG emissions.
FD12	- This document describes Fluor's vision, mission and strategy regarding the topic of sustainability.
FD13	- This document mentions the sustainability aspects that are considered important within Fluor.

#	Document description
	- Here aspects relating to environmental data are mentioned such as GHG emissions, waste generated, and water conserved.
FD14	- This document mentions the sustainability aspects that are considered important within Fluor. - Here environmental and safety aspects are mentioned including OSHA guidelines, total number of incidents, fatalities, etc.
Fluor Supply Chain documents	
FD15 (000.412)	- The purpose of this practice (000.412) is to provide requirements and guidance on Supply Chain's sourcing and supplier relationship management process. The supplier sourcing process is how potential suppliers are identified, evaluated, monitored, and selected based on their added value to Fluor and its clients.
FD16	- This document mentions the expectations Fluor has from its suppliers and contractors. - It mentions aspects of health, safety and environment (HSE), Human rights and employment practices, Sustainability, Conflict minerals, among others, which are related to sustainability
FD17	- This document provides a general overview on supply chain sustainability expectations
FD18	- This document describes the aspects of sustainability that will potentially be looked at within supply chain.
FD19	- This document discusses what Fluor is doing to embed sustainability within the supply chain and its practices.
FD20	- This document provides a compilation of information, questions and answers taken from a variety of sources. It provides responses and support information for frequently asked questions in the sustainability arena.
FD21 (000.430)	- This document (000.430) discusses HSE requirements to assist contractors in satisfying their contractual and legal HSE responsibilities in such a manner that a safe and efficient operation is established and maintained. - The sustainability aspects mentioned include environmental protection requirements, management of hazardous substances, waste management plan, among others.
FD22 (000.430)	- This document (000.430) mentions the general information to be collected from contractors regarding their overall capabilities regarding construction of certain work or services for the project. - The sustainability aspects mentioned include quality, financial status, child labor, forced labor, among others.
FD23	- This document establishes a method of green procurement for material management activities in order to purchase environmentally preferable goods and services that have lesser or reduced impact on the environment over the life cycle of the product or service.
FD24	- This document gives a brief overview on the various material management aspects that could be incorporated into procurement practices.
FD25	- This document describes a list of factors useful for supplier/contractor sustainability assessments.

#	Document description
Fluor HSE documents	
FD26 (000.653)	- The purpose of this guideline (000.653) is to provide the following: • Understanding of sustainability/Triple Bottom Line (including the economic, environmental and social aspects considered) • Explain why sustainability is important to Fluor's business and why it should be a common practice • General information for various sustainability standards • General information and contact information for sustainability organizations and rating systems - The sustainability aspects mentioned include waste minimization, pollution prevention, biodiversity, emissions, diversity, human rights, among others.
FD27 (000.653)	- This policy document (000.653) discusses Fluor's commitment to sustainable development. - The actions mentioned include providing alternative and renewable energy solutions to meet client's needs, helping clients meet energy conservation and carbon reduction targets, committing to climate action, conserving water, developing recycling and waste reduction policies, among others.
FD28 (000.653)	- This purpose of this sustainability practice (000.653) document is to be used globally on projects to implement sustainable practices in home offices and onside locations to provide environmental, economic and social benefits to Fluor and its Clients. - The sustainability aspect mentioned include environmental performance, GHG emissions, employee trainings, ethics, among others.
FD29 (000.653)	- This document (000.653) contains an overview of 69 important sustainability actions that could be used in different project scenarios. - The main sustainability aspects mentioned include energy consumption, waste generation, health and safety, skills developments, among others.
FD30 (000.653)	- This purpose of this guideline document (000.653) is to establish a structured workshop methodology that is designed to help identify sustainability opportunities available on a project that maintains objectives and are specific, credible, and measurable. - Sustainability value improving aspects mentioned include waste reduction strategies, site waste management plan, energy usage, water conservation, child labor, community involvement, among others .
FD31 (000.653)	- This purpose of this guideline (000.653) is to establish a structured Value Improving Practice (VIP) workshop methodology employed on a project to reduce waste at the source or recycle this waste in an environmentally safe manner
FD32 (000.653)	- This purpose of this template document (000.653) is to provide an opportunity to suggest sustainability initiatives in the categories of energy usage, waste reduction, water conservation, air quality, social and economic.
FD33	- This document gives a brief overview on the potential of sustainability within supply chain to influence the footprint of a business

#	Document description
FD34 (000.653)	- This document provides an overview of the HSE items to be assessed and reviewed. - The sustainability aspects mentioned include hazardous chemicals management, waste management, community impact, welfare provisions among others.
FD35 (000.653)	- This document (000.653) defines the basic requirements for environmental management controls to mitigate potential environmental impacts at Fluor project sites. - The environmental aspects mentioned include water quality, air quality, noise and vibration, waste management, among others.
Fluor external documents	
FD36	- This objective of this questionnaire document is to evaluate the different CSR management systems of Fluor and provide supporting documentation. - The evaluation focused on the following themes: General targets, Labour & Human rights, Environment, Sustainable Procurement and Ethics
FD37	- This document mentions the different criteria on which Fluor's sustainability aspects are being assessed.

APPENDIX C: SEMI STRUCTURED INTERVIEWS (Chapter 4)

APPENDIX C.1: Interview protocol

The interview protocol used in a research study acts as a guide for the interviewee during the interviews. It consists of the introduction provided to the interview, questions to be asked and concluding remarks. The interview protocol is described in detail below:

Step 1: Introduction

The interview begins with the researcher thanking the interviewee for their interest in participating in the research. The consent form and information mentioned is briefly summarized so that the purpose of the interview, use of data gathered, and the anonymity of information gathered is clear to the interviewee. This is followed by a quick summary of the main objectives of the research study and the goal of the interviews. Finally, the interviewees are asked to introduce themselves (Role and years of experience), as well as their role within or in relation to the Procurement and Contracts department. Terminology used in the interviews were also briefly addressed to ensure both the interviewee and the researcher were on the same page.

Step 2: Interview questions

The interview questions were designed based on 6 themes, described in detail below:

- **Theme 1**: Expert opinion/insight on the topic of sustainability in project procurement practices (general and current practices)
    - Goal of this theme is to gain general insight on interviewee(expert) understanding about sustainable procurement in projects
- **Theme 2**: Sustainability criteria implemented in identified projects. What went well, what did not (Specific to identified case studies)
    - Goal of this theme to ask the interviewee specific questions related to the case studies they were identified in relation with. Questions such as sustainability aspects considered during procurement practices in that project, what went well, what could have been improved, what else could have been done, etc. will be addressed here
- **Theme 3**: The sustainability criteria or indicators that can add most impact when integrated into project procurement practices
    - The conceptual sustainability framework developed was introduced to the interviewee in this theme. Goal of this theme is to get interviewee insight on sustainability criteria that can add most impact when integrated into project procurement and knowledge on any qualitative or quantitative performance indicators relating to sustainability criteria. Here the interviewees are also asked to prioritize the sustainability indicators identified in the framework (addressed in more detail in section 4.5)
- **Theme 4**: Enablers and barriers to implementing sustainable procurement
    - Goal of this theme is to understand what can potentially stimulate or hinder implementation of sustainable procurement in projects
- **Theme 5**: Current market/industry practices, requirements, or expectations regarding sustainability in procurement

  - Goal of this theme is to gain interviewee insight into ambitions regarding integrating sustainability into supply chain, what they observe currently in the industry, etc.
- **Theme 6**: Future of supply chain sustainability or sustainable procurement
  - Goal of this theme is to understand what interviewees think about the future of sustainable procurement in the industry

Based on the above-mentioned themes a set of questions were asked to Clients, Fluor and Supply Chain (suppliers/contractors) actors. The questions followed similar patterns with only few alterations based on the context of the actor being interviewed. The sample interview questions used during conducting the interviews are further elaborated below.

- **Interviewee category: CLIENT**

Theme 1: Expert opinion/insight on the topic of sustainability in project procurement practices (general and current practices)

1. What is your understanding of the term sustainable procurement?
2. What current practices or trends do you observe regarding sustainable procurement in the Energy & Chemicals/Infrastructure industry?

Theme 2: Sustainability criteria implemented in identified projects. What went well, what did not. (Specific to identified case studies)

3. In which project phase were you involved with for the xx project?
4. In the xx project, what aspects regarding sustainability were considered during procurement (in the above-mentioned project phases)?
5. What sustainability aspects do you think could have been integrated into the project procurement of this project? And why?

Theme 3: The sustainability criteria or indicators that can add most impact when integrated into project procurement practices

6. Do you have any examples of what is done in practice regarding the mentioned sustainability criteria?
7. Are there any sustainability criteria considered that you are aware of, which was not mentioned in the previous question?

Theme 4: Enablers and barriers to implementing sustainable procurement

8. How do you generally ask for sustainability targets and requirements from your suppliers/ (sub-)contractors and EPC companies? Is it specific or open questions?
9. How do you think you can incentivize or trigger sustainability from your supply chain? (suppliers/(sub-)contractors/EPC companies)?
10. What do you think makes integrating sustainable aspects into procurement a success (enablers)?

11. What barriers do you feel are currently being faced in its implementation and how do you think they can be tackled?
12. What is your opinion on sustainability criteria potentially being a determining factor in EPC/supplier/(sub-)contractor selection?

Theme 5: Current market/industry practices, requirements, or expectations regarding sustainability in procurement

13. What targets or ambitions do you have regarding integrating sustainability into procurement within your organization?
14. What aspects regarding sustainability in procurement, would you like EPC companies to pro-actively include in their bids, even if unsolicited?
15. Do you have any examples of good practices you have seen from companies you think would be beneficial for other EPC companies to learn from?

Theme 6: Future of supply chain sustainability or sustainable procurement (5 mins)

16. What are your hopes/expectations for the future regarding sustainability within procurement/supply chain?
17. What suggestions do you have for improving the implementation of sustainable procurement practices within Energy & Chemicals/infrastructure industry?

- **Interviewee category: EPC Company (Fluor)**

Theme 1: Expert opinion/insight on the topic of sustainability in project procurement practices (general and current practices)

1. What is your understanding of the term sustainable procurement?
2. What current practices or trends do you observe regarding sustainable procurement in the Energy & Chemicals/Infrastructure industry?

Theme 2: Sustainability criteria implemented in identified projects. What went well, what did not. (Specific to identified case studies)

3. In which project phase were you involved with for the xx project?
4. In the xx project, what aspects regarding sustainability were considered during procurement (in the above-mentioned project phases)?
5. What sustainability aspects do you think could have been integrated into the project procurement of this project? And why?

Theme 3: The sustainability criteria or indicators that can add most impact when integrated into project procurement practices

6. Do you have any examples of what is done in practice regarding the mentioned sustainability criteria?

7. Are there any sustainability criteria considered that you are aware of, which was not mentioned in the previous question?

Theme 4: Enablers and barriers to implementing sustainable procurement

8. How do you generally ask for sustainability targets and requirements from your suppliers/ (sub-)contractors? Is it specific or open questions?
9. How do you think you can incentivize or trigger sustainability from your supply chain (suppliers/(sub-)contractors)?
10. What do you think makes integrating sustainable aspects into procurement a success (enablers)?
11. What barriers do you feel are currently being faced in its implementation and how do you think they can be tackled?
12. What is your opinion on sustainability criteria potentially being a determining factor in supplier/(sub-)contractor selection?

Theme 5: Current market/industry practices, requirements, or expectations regarding sustainability in procurement

13. What targets or ambitions do you have regarding integrating sustainability into procurement within your organization?
14. What aspects regarding sustainability in procurement, would you like suppliers/ (sub-)contractors to pro-actively include in their bids, even if unsolicited?
15. Do you have any examples of good practices you have seen from companies you think would be beneficial for other EPC companies to learn from?

Theme 6: Future of supply chain sustainability or sustainable procurement (5 mins)

16. What are your hopes/expectations for the future regarding sustainability within procurement/supply chain?
17. What suggestions do you have for improving the implementation of sustainable procurement practices within Energy & Chemicals/infrastructure industry?

- **Interviewee category: Supply Chain (suppliers/(sub-)contractors)**

Theme 1: Expert opinion/insight on the topic of sustainability in project procurement practices (general and current practices)

1. What is your understanding of the term sustainable procurement?
2. What current practices or trends do you observe regarding sustainable procurement in the Energy & Chemicals/Infrastructure industry?

Theme 2: Sustainability criteria implemented in identified projects. What went well, what did not. (Specific to identified case studies)

3. In which project phase were you involved with for the xx project?
4. In the xx project, what aspects regarding sustainability were considered during procurement (in the above-mentioned project phases)?
5. What sustainability aspects do you think could have been integrated into the project procurement of this project? And why?

Theme 3: The sustainability criteria or indicators that can add most impact when integrated into project procurement practices

6. Do you have any examples of what is done in practice regarding the mentioned sustainability criteria?
7. Are there any sustainability criteria considered that you are aware of, which was not mentioned in the previous question?

Theme 4: Enablers and barriers to implementing sustainable procurement

8. How do you generally ask for sustainability targets and requirements from your suppliers/ (sub-)contractors? Is it specific or open questions?
9. How do you think you can incentivize or trigger sustainability from your supply chain? Similarly, how do you think supply chain can be incentivized by client/EPC company, to include sustainability into project execution?
10. What do you think makes integrating sustainable aspects into procurement a success (enablers)?
11. What barriers do you feel are currently being faced in its implementation and how do you think they can be tackled?
12. What is your opinion on sustainability criteria potentially being a determining factor in supplier/(sub-)contractor selection?

Theme 5: Current market/industry practices, requirements, or expectations regarding sustainability in procurement

13. What targets or ambitions do you have regarding integrating sustainability into procurement within your organization?
14. What aspects regarding sustainability in procurement do you think a supplier/(sub-)contractor can pro-actively include in their bids, even if unsolicited?
15. What aspects regarding sustainability are you being asked from your clients?
16. Do you have any examples of good practices you have seen from companies you think would be beneficial for other EPC companies to learn from?

Theme 6: Future of supply chain sustainability or sustainable procurement (5 mins)

17. What are your hopes/expectations for the future regarding sustainability within procurement/supply chain?
18. What suggestions do you have for improving the implementation of sustainable procurement practices within Energy & Chemicals/infrastructure industry?

Step 3: Closing the interview

The interview concludes by asking the interviewees if there was any topics missed during the discussion, that they would like to discuss. Additionally, the interviewees were also asked if they would like to see the transcripts of the interviews. Finally, the interviewees are thanked for their time and valuable feedback.

APPENDIX C.2: Interview transcripts

INTERVIEW TRANSCRIPTS

The interviewee questions were based on addressing 6 main themes. Themes 4 and 6 provided significant insights regarding the main sub-questions and were used in the report. Thus, the interview transcripts will focus on those two themes and will be expanded below.

1. CLIENT

TRANSCRIPT INTERVIEWEE: CL1

Theme 4: Enablers and barriers to implementing sustainable procurement

1. *How do you generally ask for sustainability targets and requirements from your suppliers/(sub-)contractors and EPC companies?*

- We have not asked them yet, but we could.

2. *How do you think you can incentivize or trigger sustainability from your supply chain? (suppliers/(sub-)contractors/EPC companies)?*

- I mean, let's say we're going with one EPC and we contract a subcontractor to do the construction. We could, let's say potentially give them some sort of a bonus if they make sure that there's something like, so, if you don't have any carbon emission, or if you save carbon, there's going to be a reward or something. I'm not sure if you can monetize that, but potentially you could do something like that.

3. *What do you think makes integrating sustainable aspects into procurement a success (so what are enablers)?*

- Cost
- Mindset/Culture
- Process was also green. And that kind of pushed the need to procure a particular sustainable vendor over another.
- The energy prices
- Long term vision. Personally, I think this is very important or extremely important. I mean, this is something that probably you don't do for one project, but it's something how will you totally approach projects over the long haul. Can you improve something. I think it's important.

4. *What barriers do you feel are currently being faced in implementation of sustainability into procurement?*

- So we can't afford to be very picky on which vendors we need to select. With the vendors, especially where we are currently at the package units vendors, we don't have that many options anymore. We are now pretty much single source.

- Mindset/Culture
- What we're doing, it's traditional markets. Where, let's say the work has been, you know, that there's a certain way of doing things. It's not the most dynamic market
- So I think we can in that sense maybe afford to not be the most picky when it comes to sustainability when selecting vendors. The project itself make sure that we have that we reached let's say the targets that we all want to achieve
- I think we're working with quite a few smaller family-owned business, that is very traditional
- Greenwashing

5. *What is your opinion on sustainability criteria potentially being a determining factor in supplier/ (sub-) contractor selection?*
- I would be in favor of that. Yeah.
- So I think that if you proactively start, and I think the company that does this, and that has this on its mind. I would be supportive. And I would, within reasonability make sure that we start working with them.

Theme 6: Future of supply chain sustainability or sustainable procurement

6. *What are your hopes/expectations for the future regarding sustainability within procurement/supply chain?*
- Well, my expectation and my hope is that at some point, it will be. I mean, just, it's going to be the most important topic. So, I just hope that people start recognizing this as something that is very important. Not just the money and price.

7. *What suggestions do you have for improving the implementation of sustainable procurement practices within Energy & Chemicals/infrastructure industry?*
- But in the end, it goes on the whole picture. I think if a company really starts making it a priority. Especially on bigger meetings, they start with this safety topic. Well, let's change that and make that 50 50 environmental topic. How can we do stuff better? But let's start doing that. I mean, it could be a very small thing where they could actively change, or at least start some mentality change. Maybe that's a good one for the EPC's, to do the safety topic and replace that by an environmental topic.
- Well, in the end, if EPC companies would develop some sort of frame or let's say a questionnaire, for instance, that they do send out to all suppliers. And it shouldn't be too easy to answer. I mean, its okay, if it hurts the vendors or suppliers. I mean, can you provide your latest LCA on the way you operate your business? And do you know where you source your steel? I mean, if you start asking for that, at some point, companies will respond. So maybe you could start with asking by having a questionnaire and also rank them on sustainability, show it to them and say, Hey, we made a few bid evaluations, and you do well on cost, which is very important, maybe 95%. But on the other 5%, you do very poorly, and your competitors, much better, more sustainable. So maybe that helps and, just ask from them and then open up and show them. What is the industry standard and where they are.

- I think it will benefit EPCs if they start looking at sustainability out of their own mindset. And not because the client tells them but yeah, thinking to be more proactive and trying to figure out how companies work and how they can improve as well.

TRANSCRIPT INTERVIEWEE: CL2

Theme 4: Enablers and barriers to implementing sustainable procurement

1. *How do you generally ask for sustainability targets and requirements from your suppliers/(sub-)contractors and EPC companies?*
- So we basically score bids, both technically and financially. And we go with that, and it's called the most economic valuable offer. That term in Dutch is called the EMVI (Economisched meest voordelijk inschriving)-Most economically advantageous tender. it works really, really simple. Actually, so you can score points next to on price also on well, the technical part but also on safety. Well, other characteristics of the projects that are requested by the client in this example, and of this total score, 25% should be based on sustainability.

2. *How do you think you can incentivize or trigger sustainability from your supply chain? (suppliers/(sub-)contractors/EPC companies)?*
- So provide really a game for everybody, the whole chain if, it works out.

3. *What do you think makes integrating sustainable aspects into procurement a success (so what are enablers)?*
- Legislation. Because there's legislation stating that we need to include sustainability, with a certain percentage in the procurement contracts phase. I think that's a good thing, because it is included also when it costs a lot of money, then, nevertheless, we will do it.
- Like an open book translation (early supplier involvement). And you can just discuss on Hey, how can we do this in the best way?
- Client. Yeah. I think especially the including the 25% hard requirements, is already one of these big enablers that the client can do that.

4. *What barriers do you feel are currently being faced in implementation of sustainability into procurement?*
- Lack of client interactions with bidders, as an EPC company would have a managing contractor role, so interactions between client and bidders will be less.
- Another one I think, is window dressing. So because of this strict legislation, actually in this public sector, contractors exactly know how to frame themselves, to score really good in the bidding phase. And thereafter. They also know how to make sure that they don't have to go actually all the way.

- Another barrier is I think that, especially in this public company, there are really a lot of people who work there for like, 20 years, 30 years, they're really used to do it, and they don't really see the point of sustainability.

5. *What is your opinion on sustainability criteria potentially being a determining factor in supplier/(sub-)contractor selection?*
   - Right now that's what we do, where we give 25% to sustainability which also affects the choice we make.

Theme 6: Future of supply chain sustainability or sustainable procurement

6. *What are your hopes/expectations for the future regarding sustainability within procurement/supply chain?*
- I think that in 10 years from now, especially in the public sector, there will be more legislation on this. It will be rather rigid. But on the other hand, it just gives very clear goals, also to the market.

7. *What suggestions do you have for improving the implementation of sustainable procurement practices within Energy & Chemicals/infrastructure industry?*
- Having an open book translation (between client and contractors)
- I think also having like a follow up or improvements during the contracting phase

TRANSCRIPT INTERVIEWEE: CL3

Theme 4: Enablers and barriers to implementing sustainable procurement

1. *How do you generally ask for sustainability targets and requirements from your suppliers/(sub-)contractors and EPC companies?*
- I think it differs per project. Of course, it's more important to have the real dialogue and to check if it really happens.

2. *How do you think you can incentivize or trigger sustainability from your supply chain? (suppliers/(sub-)contractors/EPC companies)?*
   - I think, by giving more freedom in the questions. I think if you give more freedom, I think you get a more sustainable creative ideas. So I think don't specify too much.

3. *What do you think makes integrating sustainable aspects into procurement a success (so what are enablers)?*
- I think from our perspective, we need to ask for options that reduce energy water, greenhouse gas. And yeah, we don't always know the most new technologies or contractors that could be more

sustainable. I think there a party like an EPC company can ask and give us advice about sustainability integration in projects.
- Looking at at least part open book. For example that you, as a client can trust that the EPC contractor doesn't count in 30% on only steel, for example. If you manage to give that trust, I think that helps to to get procurement in projects done in that way.

4. *What barriers do you feel are currently being faced in implementation of sustainability into procurement?*
- I think clients plays a role. It can always be improved, but I think clients have a lot of things they have to take into account, especially in the chemical site, where safety is also very important. And you have already a very long list of things that should be included in a project. And then sustainability is just one of them. So it, it feels less important.
- I think big clients, mostly have a very detailed question to ask EPC companies. And that complicates it. Because then you have less freedom to bring more sustainability in it sometimes.

5. *What is your opinion on sustainability criteria potentially being a determining factor in supplier/(sub-)contractor selection?*
- Yes, it could be of value. But it depends very much on the project, whether or not the contractor can be selected

<u>Theme 6: Future of supply chain sustainability or sustainable procurement</u>

6. *What are your hopes/expectations for the future regarding sustainability within procurement/supply chain?*
- I think sustainable procurement is starting now. And I think more legislation will come in the future.

7. *What suggestions do you have for improving the implementation of sustainable procurement practices within Energy & Chemicals/infrastructure industry?*
- I think that a lot of clients that operate chemical sites are more generalist and for example, our procurement department, they have also a focus area, but it's very broad. So they are not the technical expert. So I think there they need help from the EPC contractor to include sustainability.
- I think would be good if you have rewards for the amount of sustainability they can include in the project.

TRANSCRIPT INTERVIEWEE: CL4 & CL5

Theme 4: Enablers and barriers to implementing sustainable procurement

1. *How do you generally ask for sustainability targets and requirements from your suppliers/(sub-)contractors and EPC companies?*

- They have to calculate the things given in the MKI calculation, so that's fixed.

2. *How do you think you can incentivize or trigger sustainability from your supply chain? (suppliers/(sub-)contractors/EPC companies)?*

- We don't have any bonus, but we have some fee per kilowatt hour. So if they use more, they pay it at the end. so they pay more money for more energy consumption, and if they use lesser then less they pay.
- Maybe looking at having audits.
- I think that we can, we talked earlier about, we have these goals on a national level, and also European level and well, we are really from you know, the executing, we are executing organization. So, we really need to make the translation of these really high level goals to our contracts.

3. *What do you think makes integrating sustainable aspects into procurement a success (so what are enablers)?*

- MKI calculation is how we ask sustainability from our contractors or EPCs.
- Also the government and legislation also pushes the topic.
- Also looking at what can be done not right now for a project, but what will also be beneficial in the future.
- There's a whole mindset has been turning around about how we use energy, how we use material

4. *What barriers do you feel are currently being faced in implementation of sustainability into procurement?*

- Still the cost efficiency is looked at. At yet we don't have any triggers to motivate more from our contractors.
- Budget is also sometimes a problem
- This is what is really hard about this type of contract that we work in because it's the DBFM. And it's such a long period of time. And the contract is already written in 2008, or something. Contract close was in 2014. It's sometimes hard to adjust these contracts with these very ambitious goals that we have right now.

5. *What is your opinion on sustainability criteria potentially being a determining factor in supplier/(sub-)contractor selection?*

- No response.

Theme 6: Future of supply chain sustainability or sustainable procurement

6. *What are your hopes/expectations for the future regarding sustainability within procurement/supply chain?*

- No response.

7. *What suggestions do you have for improving the implementation of sustainable procurement practices within Energy & Chemicals/infrastructure industry?*

- some times you hear that, that organizations have certain ambitions, but they don't do it because they think it doesn't fit in. Maybe this would be different if we would have more of a connection with those parties, or if it would come to us through the SPC company, then we can look into it, if we can do something with it, you know, maybe we can change the contract, or maybe we have the budget for it.
- I think we all need to go together and we need to identify with the whole chain. Where are places where we can magnify the strengths in the whole chain and understand our roles. Also understand the role of the contractors, And what are the tools they have. And also the subcontractors.

2. EPC (Fluor)

TRANSCRIPT INTERVIEWEE: F1

Theme 4: Enablers and barriers to implementing sustainable procurement

1. *How do you generally ask for sustainability targets and requirements from your suppliers/(sub-)contractors and EPC companies?*

- I don’t see too much of that. Okay. And I think it is, again, a matter of cost. I think the issue is with our clients is that the silos are totally apart with our clients. So you have a project silo, and you have a HSE silo, and they are not connected. they just get a budget, and please do the project. So there is no too much of a motivation. I think we are very close to the point that that connection will be made. And then you can have a whole different ballgame. So it's important that we are organized at our side to be able to do that.

2. *How do you think you can incentivize or trigger sustainability from your supply chain? (suppliers/(sub-)contractors)?*

- I think by following the general guidelines coming from the authority, and that will have a snowball effect downstream.

3. *What do you think makes integrating sustainable aspects into procurement a success (so what are enablers)?*

- It just comes down to money, as usual.
- Another thing what is driving them is because they want to remain market leader. So they need to invest in new processes, they need to increase the capacities. And they can only do that when they do that on a sustainable way
- Image
- Client requirements (And they are in the transition process. We are not in a point yet that our client says, say, you have maximum this co2 footprint per employee, otherwise you don't work for us. We have no clients in that respect. Sometimes they use it in the evaluation, but not as a evaluation criteria.)
- Gas prices and energy prices. It's quite an easy driver. With a high energy prices, it's quite easy to make to make that evaluation. Because when you use 10, or 20%, more energy, yeah. It is much more expensive. So it's not from, as I mentioned earlier, a noble point of view, where we have an opportunity to reduce co2. No, we are just reducing the running cost of the plant. And I think that is the wrong driver.
- Big players in the market will change the game. These kind of big companies, they will change and change the market, they will start pushing these kinds of criteria.

4. *What barriers do you feel are currently being faced in implementation of sustainability into procurement?*

- It just comes down to money, as usual
- That everybody's looking at each other. So everybody's looking, hey, why don't they do anything, I also do nothing. Because when I do something, my product gets more expensive. And then I lose the competition. So we are all driven by money again.

5. *What is your opinion on sustainability criteria potentially being a determining factor in supplier/(sub-)contractor selection?*

- I don't see it happening yet. But I'm convinced it will happen.
- But what I prefer, and I like to be creative. I think that's the most exciting part of our job. So really putting or giving our suppliers, at least the kind of direction, but an open question, what can you do to make this process or this project much more greener than as we would do in a conventional way. I think, when you do it too much of a direction, then it will be a lies contest again. They will start self-optimizing performance on that particular goal.

<u>Theme 6: Future of supply chain sustainability or sustainable procurement</u>

6. *What are your hopes/expectations for the future regarding sustainability within procurement/supply chain?*

- But there will be a point that there will be a much stronger driver from the client. I think that will be an interesting, interesting point. And the lifecycle discussion on itself.

8. *What suggestions do you have for improving the implementation of sustainable procurement practices within Energy & Chemicals/infrastructure industry?*

- Instead of only having like a top-down approach, you still give the openness to other actors to kind of pitch in their idea.
- Maybe we need to make like a long and short list. Because you don't want to have 10 suppliers working all their ideas out in detail. Maybe when we have a rough outline of what we want to achieve, we share it with supply chain, and they can give their thoughts and then we step into the next phase with the three most promising suppliers.
- Maybe looking at field contractor, so the contractor coming to site and weld all the pipes together and build it all together. I think their impact which scope one and two is much bigger, because they have all people moving around back and forth, they have many more waste streams, and they have temporary facilities at the site. So maybe you need to differentiate, let's say equipment and instruments suppliers versus field contractor.

TRANSCRIPT INTERVIEWEE: F2

Theme 4: Enablers and barriers to implementing sustainable procurement

1. *How do you generally ask for sustainability targets and requirements from your suppliers/(sub-) contractors and EPC companies?*

- there's a very specific MKI calculation, which we have to comply with, and also contractors, which are our subcontractors on the project. All those scores combined, have to stay beneath a certain level. We have to, we have to comply with it.

2. *How do you think you can incentivize or trigger sustainability from your supply chain? (suppliers/(sub-)contractors/EPC companies)?*

- What's there again, it's following the general guidelines coming from the authority, and that will have a snowball effect downstream.
- So, you can see that because indeed, these subcontractors and supplier know that they will be more and more judged on their, for example, MKI score. Not only from that perspective, but also from a whole advertising perspective. As soon as, as they have one, electrical truck, they put it on the website, we invest in more durable environments, etc. So, the public opinion, of course ,is very important to them.

3. *What do you think makes integrating sustainable aspects into procurement a success (so what are enablers)?*

- Client requirements, as well as the financial benefits of sustainability of procuring sustainably.

- If there are very specific criteria, then in the bid evaluations, these will become listed and will have a higher importance in selecting the subcontractors. And if there are no requirements. To be honest, it's focused on price, price and price.

4. *What barriers do you feel are currently being faced in implementation of sustainability into procurement?*
- Because of the very strong competition in the contracting land specifically in civil works. Most EPC contractors will only follow those guidelines from the tender and if there are no goals on sustainability and it will cost them more to invest in sustainability goals, they can be skipped from winning the contract and as a client we cannot do anything else than giving the project to the cheapest EPC contractor.

5. *What is your opinion on sustainability criteria potentially being a determining factor in supplier/(sub-)contractor selection?*
- No response.

Theme 6: Future of supply chain sustainability or sustainable procurement

6. *What are your hopes/expectations for the future regarding sustainability within procurement/supply chain?*
- I think the way forward is that these kinds of sustainability criteria become more specific, and therefore play a bigger role in this bid valuations. And by that the selection.

7. *What suggestions do you have for improving the implementation of sustainable procurement practices within Energy & Chemicals/infrastructure industry?*
- By asking more detailed questions on their way of working and not being too generic.

TRANSCRIPT INTERVIEWEE: F3

Theme 4: Enablers and barriers to implementing sustainable procurement

1. *How do you generally ask for sustainability targets and requirements from your suppliers/(sub-)contractors and EPC companies?*
- Right now, I think it's more a tick in the box.

2. *How do you think you can incentivize or trigger sustainability from your supply chain? (suppliers/(sub-)contractors/EPC companies)?*
- I think that we need to give it more attention and more importance. And to really go when a project starts at the very beginning to do some kind of workshops, to involve the client to make everybody

kind of think about sustainability and designing things in a sustainable way and things like so. I think that that's a little bit the way to go to encourage more, those kinds of workshops and things like that

- Like a Bonus Malus. So whoever doesn't have this, then you add a little bit to make it more expensive. And in the end I think it's not far from reality, so its not so fictitious, because in the end, if it's more sustainable investing in the long term, it will for the clients, cost them less.

3. *What do you think makes integrating sustainable aspects into procurement a success (so what are enablers)?*

- Clients play a role in it, definitely.
- By having vendors in early design and involvement.
- We have to contribute to create awareness and contribute that actors think it's important to do that, because that will also open their doors for new businesses.

4. *What barriers do you feel are currently being faced in implementation of sustainability into procurement?*

- Client could be a barrier
- Price still matters a lot.

5. *What is your opinion on sustainability criteria potentially being a determining factor in supplier/(sub-)contractor selection?*

- Client selecting EPC: Yes totally. That would also force us to be more sustainable. EPC selecting suppliers: I think I wouldn't do it just because of that, but I would use a kind of Bonus Malus thing. So whoever you know, giving them a little bit of an advantage the more they are engaged in the sustainability aspects.

<u>Theme 6: Future of supply chain sustainability or sustainable procurement</u>

6. *What are your hopes/expectations for the future regarding sustainability within procurement/supply chain?*

- I hope that we really integrate it in our processes, and the sooner the better, basically, that we at least evaluate it first. That you still ask the questions and that is not just a tick in the box. and that you follow up on that.

7. *What suggestions do you have for improving the implementation of sustainable procurement practices within Energy & Chemicals/infrastructure industry?*

- We have people very motivated and really willing to do that. You know, so I think we can do more, or we are not probably aware of how much we can do because just by even asking these questions, vendors will start doing as they will think this is something we consider as something to evaluate, you know. So they would start if they haven't, they will start doing something about it, hopefully. So one thing leads to another one. And that's how things change in the end.

TRANSCRIPT INTERVIEWEE: F4

Theme 4: Enablers and barriers to implementing sustainable procurement

1. *How do you generally ask for sustainability targets and requirements from your suppliers/(sub-)contractors and EPC companies?*

- In our contracts, we have some wording and in Pre-Quals, we ask questions but this has to be improved upon.

2. *How do you think you can incentivize or trigger sustainability from your supply chain? (suppliers/(sub-)contractors/EPC companies)?*

- I think we need to educate our buyers/contracts people to be aware of sustainability and what to ask suppliers.
- As an EPC company, we can be triggered if the clients assign a budget to sustainability.

3. *What do you think makes integrating sustainable aspects into procurement a success (so what are enablers)?*

- Our buyers our clients, our suppliers should all be aware of, how exactly they are procuring, that they are following proper procedures and practices and specifications.
- So clients play an important role. At the end it is the client who spends the money.

4. *What barriers do you feel are currently being faced in implementation of sustainability into procurement?*

- Clients do sometimes act as barriers. Not all the time.
- Most of the times it has something to do with budgets (so costs) and schedule, and people. And theres never enough money on any project.
- (Greenwashing) I think when you get a project, it's always, you know, at the forefront that we're sustainable. We want to do this, want to that, we want to be the best. But a lot of it sometimes I think is showing face. In reality, that's not really happening. I think that they should be doing a lot more.
- (Sustainable efforts will make the bid more expensive and you will loose to competition) we also are competitively bidding with other or competitors, other companies, EPC companies. And as soon as we put in more money in that will then they will give the project to our competitor.

5. *What is your opinion on sustainability criteria potentially being a determining factor in supplier/(sub-)contractor selection?*

- I think it’s a good idea selecting SC based on sustainability criteria, but there are many different aspects to consider, like single source suppliers, agreements already in place with suppliers and Clients and EPC (Fluor) has to use them.

Theme 6: Future of supply chain sustainability or sustainable procurement

6. *What are your hopes/expectations for the future regarding sustainability within procurement/supply chain?*

- This is now a hot topic and is being given more serious attention.

7. *What suggestions do you have for improving the implementation of sustainable procurement practices within Energy & Chemicals/infrastructure industry?*

- Looking at how sustainability can be integrated into the prequals that we send out to suppliers.
- Also not just ask the question, but also be proactive and follow up. So do a survey or something to check if they actually do what they say.
- Clients need to set aside a budget for this.
- Suppliers and contractors can also mention the measures they take regarding sustainability in their practices.
- Educate people in Supply Chain, more wording in contracts.

TRANSCRIPT INTERVIEWEE: F5

Theme 4: Enablers and barriers to implementing sustainable procurement

1. *How do you generally ask for sustainability targets and requirements from your suppliers/(sub-)contractors and EPC companies?*

- Yeah, I think honestly, if we look at currently, how businesses are catered, is we're just still on the on the very first step, right of what sustainability really.

2. *How do you think you can incentivize or trigger sustainability from your supply chain? (suppliers/(sub-)contractors/EPC companies)?*

- Maybe looking at how the sustainable criteria can be measured or evaluated.
- Also maybe looking at fictive discounts and such.

3. *What do you think makes integrating sustainable aspects into procurement a success (so what are enablers)?*

- Because of their company culture.
- Because it better positions them.
- Because the market, you know, demands that.
- Their shareholders demand that which is why it has been translated into the incorporation of the procurement.
- The client role is massive. I think the client really dictates what we would as an EPC focus on.

4. *What barriers do you feel are currently being faced in implementation of sustainability into procurement?*

- You're sometimes in such a specialized business within the, in the energy solutions market, you're buying very specific materials and equipment
- Transparency is I think, a major issue there
- If they let's say make a leap towards that I have experienced that it is tricky sometimes to give them (SC) enough credit for that and have that translated in the evaluation of a certain contract.

5. *What is your opinion on sustainability criteria potentially being a determining factor in supplier/(sub-)contractor selection?*

- I think that would be good. I think if it were up to me, it would be much more. You can either follow the market, you know, the big trends in the market. And in my opinion, you're always a bit behind them, where you can kind of really make a leap as a company and say, Hey, this is although not really valuable within the market as such, we're going to fully invest in this, because we think that in five or 10 years from now, this is what clients will, and this is what the market wants.

Theme 6: Future of supply chain sustainability or sustainable procurement

6. *What are your hopes/expectations for the future regarding sustainability within procurement/supply chain? Do you see any trends happening that would support more sustainability strategies being integrated into procurement practices in projects?*

- Nothing comes to mind now than what we discussed earlier.

7. *What suggestions do you have for improving the implementation of sustainable procurement practices within Energy & Chemicals/infrastructure industry?*

- Every organization or at least an EPC contractor, or clients or subcontractors have dedicated HSE personnel. Maybe in the future I bet there's similar positions only cater towards sustainability
- Saying that one of the things we will be looking at while shortlisting suppliers will be sustainability.
- Maybe assigning a score to the sustainability criteria so that it can be measured or evaluated and incorporate it into our procurement.

TRANSCRIPT INTERVIEWEE: F6

Theme 4: Enablers and barriers to implementing sustainable procurement

1. *How do you generally ask for sustainability targets and requirements from your suppliers/(sub-)contractors and EPC companies?*

- As of now it is more voluntary stuff. If you really want to push suppliers to make efforts in sustainability, there should be a benefit for them or a reward for them or punishment in the negative sense.

2. *How do you think you can incentivize or trigger sustainability from your supply chain? (suppliers/(sub-)contractors/EPC companies)?*

- But then you come back to the question, how much are you willing to pay for it. But I agree, as an approach, that should be the case that we say, okay, if we typically buy something, the first thing we look at is it technically acceptable. If it's technically not acceptable, we don't even look at the rest. But then say you have a couple of, let's say, three companies left, which are technically acceptable, and we typically buy the cheapest of the three. And if you could incentivize, incentivize somebody with a sustainable company with a fictive 10% discount. And that could change the outcome of the discussion.

3. *What do you think makes integrating sustainable aspects into procurement a success (so what are enablers)?*

- The client. Especially in the type of contracts we are buying for and on behalf of our clients. That's, I think, the bigger part of our procurement projects. So we don't determine what the requirements are. It's our clients, we actually just do the work. So if the client just wants to go cheap, cheap as possible, then that's the name of the game. If they want to go sustainable, then that's the name of the game.
- If you have ongoing business with a certain supplier, which which delivers a certain goods every month again and again and again and again, it's much easier to to have these kinds of requirements in place.
- If you really want to make sure that sustainability, the topic of sustainability is growing and picked up, you should make it part, it shouldn't be a separate topic. It's should be part of the common approach and thinking, and if it's also more economical at the same time, then all the better.

4. *What barriers do you feel are currently being faced in implementation of sustainability into procurement?*

- It's very difficult in a project environment like we do here because its mostly one time flowdown of requirements. It's much easier in an environment of maintenance and operations where you have repeating business with a similar company rather than with one company. That's much easier to introduce. In one time buying it's much more difficult so you don't see anything in our current purchase orders towards the market.
- We don't determine what the requirements are. It's our clients, we actually just do the work.
- I think it's still at the level of a sales tool at the moment. At the moment, we are not yet at the level where it's really an integrated approach for most sellers.
- It should be measurable. And you should be able to put it in a contract and put it in in a contract means it should have consequences if you don't do it. And personally, I'm very much still struggling with that. I wouldn't know how you could define something in contractual language about sustainability.

5. *What is your opinion on sustainability criteria potentially being a determining factor in supplier/(sub-)contractor selection?*

- I think if you're talking about selecting EPC companies, it certainly should be an important factor.

- And if you're talking about procurement of services, so what we call contracts here at Fluor, I think it could be because they're you much more into how they are day to day executing sustainability factors. It happens on your job site, people are behaving, people are using chemicals and stuff and whatever. It's a lot about behavior, I think there it's really important.
- In flowing it down to suppliers of materials, it's more difficult. Because then you should really try to start telling them how to do their job. And that's not typically the approach we take.

Theme 6: Future of supply chain sustainability or sustainable procurement

6. *What are your hopes/expectations for the future regarding sustainability within procurement/supply chain?*
- I really hope we can make it make a definition of the requirements and make a measurable way of how we can deal with this towards our suppliers. I really hope we can make that step.

7. *What suggestions do you have for improving the implementation of sustainable procurement practices within Energy & Chemicals/infrastructure industry?*
- Give a punishment if sustainability aspects mentioned are not met.
- And if you could incentivize, incentivize somebody with a sustainable company with a fictive 5-10% discount. And that could change the outcome of the discussion.
- Giving sustainability a weightage in technical bid evaluation. I think that would be really good. And what I'm thinking then is sustainability in design, for instance. So if we buy a whatever piece of equipment, I can imagine that if the fuel consumption of their design is better than the fuel consumption of another bidder, you could score that you could rate that or co2, co2 emissions of certain equipment, if there's a better rating on that one that you could give that a beneficial score.

TRANSCRIPT INTERVIEWEE: F7

Theme 4: Enablers and barriers to implementing sustainable procurement

1. *How do you generally ask for sustainability targets and requirements from your suppliers/(sub-)contractors and EPC companies?*
- We mainly ask them in our pre-quals and you see aspects also in HSE.

2. *How do you think you can incentivize or trigger sustainability from your supply chain? (suppliers/(sub-)contractors/EPC companies)?*
- To me, yeah, the simplest way is to link sustainability to money, and especially to savings, you know. So if you say that by going with a contractor or supplier that is sustainable, I save money that will create an incentive, because that will link sustainability to the biggest, the most common project driver, which is money/costs.

- Well, I would first, what I would do is on a project environment, I would address it, you know, as early as possible, see what they're doing with it, like pre qualification. Also, in the bidders lists, I would try to combine good capable bidders that do have resources that they also look at sustainability, that's how I would approach it. What I've seen is that the most impactful approach is outside of project execution. So on an industry level, so instead of going in every project and say, Okay, I'm going to work with this guy, and this guy, and Hey, guy, do you have these sustainability practices. Instead of doing that, I think more more impactful is if, for example, would organize sustainability week or sustainability event, you know, and then invite key suppliers and key contractors that were doing business, and then have a discussion with them and say, Hey, guys, like, this is what our world is doing at the moment. This is what the regulations say to us, How can we actually make it an industry standard together, and also clients as well. So basically, you get the whole industry or the big players within the industry, and then you start talking about it, if you do that, then that will create an industry standard.

3. *What do you think makes integrating sustainable aspects into procurement a success (so what are enablers)?*

- The client's needs always prevail. So the client's needs, determine the project drivers. So if the client does have sustainability in their focus, then that will be shown as a project driver. And then that will flow down to the EPC contractor, and then to the downstream, basically.
- Downstream suppliers and the contractors, the more sustainability focused they are, they could try to influence us and potentially, you know, bring that sustainability focus up towards the client as well. So they could also act as enablers.
- Client profile. I think that's also something to consider. Because newer, smaller clients typically are a lot more open minded than, than the Big Oil and Gas guys.
- Policies/regulations
- The simplest way is to link sustainability to money, and especially to savings, you know. So if you say that by going with a contractor or supplier that is sustainable, I save money, that will create an incentive, because that will link sustainability to the biggest, the most common project driver, which is money/costs.

4. *What barriers do you feel are currently being faced in implementation of sustainability into procurement?*

- Client can also be a barrier, right, depending on how sustainability focused they are.
- With traditional oil and gas guys, the case is, they know what we can do. They know our culture, we know their culture. We know each other's contractual terms and expectations. So they will come to us. And they will say, Well, I want you to build this at the lowest cost possible. Usually, that's the case. And that was the case up to now. So I think the profile of the client also plays a role in how this is built as well.
- Priority to the topic. Things that I mentioned like quality safety manpower etc, can determine the success of the project, or the failure of the project, can sustainability do that..You know, it's more sustainability at this point is more a nice to have.

5. *What is your opinion on sustainability criteria potentially being a determining factor in supplier/(sub-)contractor selection?*

- Importance about sustainability is extremely high. Relevance is something else. Because, like I said before, you know, relevance is how much do you need it now? And what is the impact that it will have now. Of course, that doesn't mean that we shouldn't focus on it. I mean, at some point, we have to eventually start looking at these things.the later we do it, the worse it is. So yeah, I would say yes, it's a very important and also increasingly relevant.

Theme 6: Future of supply chain sustainability or sustainable procurement

6. *What are your hopes/expectations for the future regarding sustainability within procurement/supply chain? Do you see any trends happening that would support more sustainability strategies being integrated into procurement practices in projects?*

- I would like to see like I said before, an industry wide effort to make sustainability a priority.
- And I think that the main drive will be the sustainabilityis policies or regulations that governments and unions in European Union or governments impose. So if they impose certain regulations, those will flow down the the requirement for sustainability.

7. *What suggestions do you have for improving the implementation of sustainable procurement practices within Energy & Chemicals/infrastructure industry?*

- We could add sustainability criteria in our technical bid evaluation.

TRANSCRIPT INTERVIEWEE: F8

Theme 4: Enablers and barriers to implementing sustainable procurement

1. *How do you generally ask for sustainability targets and requirements from your suppliers/(sub-)contractors and EPC companies?*

- No response.

2. *How do you think you can incentivize or trigger sustainability from your supply chain? (suppliers/(sub-)contractors/EPC companies)?*

- Discounts or incentives costs money. If you can have the source of the sustainability addressed to the end product, which gives an added value to the end product. If that bridge can be made to the end product, then you can talk about that kind of structures.
- This topic needs to be more and more addressed in the inquiries.
- Thereshould be really more the paragraph in our inquiries with a sort sort sort of system which can address it to the end product or but also have measurements in it.

3. *What do you think makes integrating sustainable aspects into procurement a success (so what are enablers)?*

- The cost, of course, the production costs are the main driving factor in it. So if a supplier can sell his product with the profit margin and the lowest production costs, then he has economically the best business.
- The client can say, we invest some more money to it, that your machines will be more sustainable to it. So in that prospective client can have a driven position to it.
- Drive to lower opex costs.

4. *What barriers do you feel are currently being faced in implementation of sustainability into procurement?*

- That they have to build as cost efficient, lowest cost.
- There has to be margin for the supplier that he can address to have a profit. And if he starts thinking about making things sustainable, but he has to pay for it, for example, and larger in the factory or make a special installation for it or something, that is possible, but then his end project will have a higher cost, price. Thats not competitive for him. So his final business model is not competitive.

5. *What is your opinion on sustainability criteria potentially being a determining factor in supplier/(sub-)contractor selection?*

- The question is still what is the added value to the end of product and how to do it and that's not clear. So the question can be raised but it should be developed to the end product as added value from the supply chain.

Theme 6: Future of supply chain sustainability or sustainable procurement

6. *What are your hopes/expectations for the future regarding sustainability within procurement/supply chain?*

- I hope we can develop a more sustainable system. But then again, with more KPIs to the added value, and that we can address that more. Also having more understanding that it will cost extra to have a more sustainble product and that we have to accept that to make a better environment for all.

7. *What suggestions do you have for improving the implementation of sustainable procurement practices within Energy & Chemicals/infrastructure industry?*

- More and more addressed in the inquiries.
- Adding meaurement methods to the sustainble criteria and then go more deeper into it fthat you have a score for those aspects.

3. (Sub-) contractors

TRANSCRIPT INTERVIEWEE: CO1

Theme 4: Enablers and barriers to implementing sustainable procurement

1. *How do you generally ask for sustainability targets and requirements from your suppliers/(sub-)contractors?*

- So far we don't ask anything. What is missing is the knowledge of what to ask suppliers to be sustainable or not.

2. *How do you think you can incentivize or trigger sustainability from your supply chain? (suppliers/(sub-)contractors)? Also, how do you think clients can incentivize sustainability from you?*

- Maybe giving them discounts. So if I go to my supplier and they are sustainable, or they are ready to be, so maybe we could be ready to pay a higher price just for the fact that they are sustainable. But again, these costs should be let's say paid back by a benefit that today I don't see. But if it is like that, this can be a way to start this process.
- Clients can incentivize us, by showing that they have a focus and have interest in this topic.

3. *What do you think makes integrating sustainable aspects into procurement a success (so what are enablers)?*

- Client. Because the client is the leading of what do you wish to receive. If the client doesn't care, of course, he get for what he pays. That's one of the reasons mostly is the owner can be the driving of the chain to go look for sustainable way to product
- The government or European laws that must drive to one direction that require absolutely to do something.

4. *What barriers do you feel are currently being faced in implementation of sustainability into procurement?*

- The government are not requiring any, any support on that or any feedback on that. And until this is not required, nobody will focus on that.
- Client. Because the client is the leading of what do you wish to receive.
- They should see the convenience to do that. Convenience is not only economical convenience but is also a convenience in production, convenience in the way how to sell the product maybe they can sell a green product and it will be sell faster than if we try and sell the normal one let's say. So until they don't see these feedback in terms of economical or practical or some benefit it will not easy that it will be done automatically all by themselves
- There is no culture for the sustainability.
- EPCs don't know which can be the key things that can be conducted to sustainability.

5. *What is your opinion on sustainability criteria potentially being a determining factor in supplier/(sub-)contractor selection?*
- Sustainability alone, I don't think is a good criteria. Because in our work, we have a hierarchy, we pay attention on safety and quality. So if you're just sustainable, and you're not safe, and you are not working in quality, what's the benefit.

Theme 6: Future of supply chain sustainability or sustainable procurement

6. *What are your hopes/expectations for the future regarding sustainability within procurement/supply chain?*
- *That the game becomes clear and fair for all.*

7. *What suggestions do you have for improving the implementation of sustainable procurement practices within Energy & Chemicals/infrastructure industry?*
- If the client clearly mentions in the specifications that he wants to do things in a sustainable way then I can also go to my suppliers with that requirements.
- Also the rules must be clear. Otherwice we just waste time thinking that we are doing everything good, everything sustainable, which is not maybe the case.
- They must find a way to make it adaptable to be followed from the market.

TRANSCRIPT INTERVIEWEE: CO2

Theme 4: Enablers and barriers to implementing sustainable procurement

1. *How do you generally ask for sustainability targets and requirements from your suppliers/(sub-)contractors?*
- *No response.*

2. *How do you think you can incentivize or trigger sustainability from your supply chain? (suppliers/(sub-)contractors)? Also, how do you think clients can incentivize sustainability from you?*
- Clients can incentivize us by showing that this is a priority for them.
- We can towards pour suppliers do audits and discuss with them regarding sustainability.
- Another simple way is, putting the sustainability on the agenda as the safety is.

3. *What do you think makes integrating sustainable aspects into procurement a success (so what are enablers)?*
- The client. Absolutely.
- Profit fromthe side of the client can impact our business well, because then you will end up not doing some thing that you probably should do.

- The law. Factors like the government.
- Awareness within company and with all stakeholders that we have internal and external
- I'm sure that sustainable aspects in prourement is something that if you have open discussions with clients that you can achieve together.

4. *What barriers do you feel are currently being faced in implementation of sustainability into procurement?*
- The client. If the client is not willing to pay additional for sustainable things, then it will impact in the, let's say negative way.
- My experience is that the focus from the clients to the sustainability is very low.

5. *What is your opinion on sustainability criteria potentially being a determining factor in supplier/(sub-)contractor selection?*
- Again, that's within company, that's something that, you know, the problem that you often see is that it comes to the money in the end, because for clients to ask sustainable from companies and so on, that means that the companies have to have the money to invest in sustainability.

Theme 6: Future of supply chain sustainability or sustainable procurement

6. *What are your hopes/expectations for the future regarding sustainability within procurement/supply chain?*
- I think that's what has to be done is because normally, you see, we don't do anything unless we have to. So we need to start looking at the topic of sustainability.

7. *What suggestions do you have for improving the implementation of sustainable procurement practices within Energy & Chemicals/infrastructure industry?*
- I think sustainability is something that has to be discussed in the regular meetings that we have. So asking how is your performance regarding environmental aspects.

TRANSCRIPT INTERVIEWEE: CO3

Theme 4: Enablers and barriers to implementing sustainable procurement

1. *How do you generally ask for sustainability targets and requirements from your suppliers/(sub-)contractor?*
- *Currently I don't see too much of that.*

2. *How do you think you can incentivize or trigger sustainability from your supply chain? (suppliers/(sub-)contractors)? Also, how do you think clients can incentivize sustainability from you?*
- Our clients can incentivize us by paying the extra costs. It's all about, it's all about money.

- As a contractor we can aslo incentivize our SC. As soon as I know that, we have to go green put it that way. I can ask him for both solutions, definitely cheapest and the greenest. And then our sales department can work with the cheapest and the greenest.

3. *What do you think makes integrating sustainable aspects into procurement a success (so what are enablers)?*
- The client. When the client is willing to pay the extra cost for more sustainable products, Why not? Hes paying for it so we can provide it.
- When you're talking about government, government projects, they push for sustainability. But they pay for it.

4. *What barriers do you feel are currently being faced in implementation of sustainability into procurement?*
- At the moment being sustainable means that you have to spend money on it. That's most of the time the conflict, you know how you can be a little bit more sustainable, but its costing money. And then you have to make the choice. And in the industry, less sustainable products are the cheapest ones.
- The client. The client has to be willing to pay the extra cost for more sustainable products.
- The industry itself at the moment is still the non sustainable.
- Also for many products, there is not a one to one equivalent.
- Mindset of people. you have to start changing the mentality of the people.

5. *What is your opinion on sustainability criteria potentially being a determining factor in supplier/(sub-)contractor selection?*
- When everything is the same, so technical, commercial etc. I will choose the greenest. But the price differences are still too big. And I think also the whole world is working to reduce these differences. And of course also by law and government by simply set the forbidding certain products. The prices are coming nearer to each others and the choice will be smooth or what we as companies have to work on smaller differences.

<u>Theme 6: Future of supply chain sustainability or sustainable procurement</u>

6. *What are your hopes/expectations for the future regarding sustainability within procurement/supply chain?*
- I think also the future probably even in the future of procurement, there'll be much more green as it is today because of awareness of the complete chain and we have to keep on preaching that green is a possibility too.

7. *What suggestions do you have for improving the implementation of sustainable procurement practices within Energy & Chemicals/infrastructure industry?*
- Looking at ways on how material could be sold back to the supplier instead of dumping it. I think it's a very good idea. And when, when our clients are willing to pay for it, why not, of course, then you

need the whole complete control chain on it. Because it's very nice to get the money for recycling your waste.

- The first thing I always say is that you have to keep explaining what you want, up until the people understand what you want and the reason behind that you wanted. Spend money on this, spend time on it. Sometimes processes like that will take months. Because also the guy who is wiping the floor must understand why we are doing that. And what's the reasoning behind it. As soon as people understand things, it's much easier to let them change it and get them to do it.
- It's always very good to market, the possibilities. And I think all companies has to do it, just to make clients aware of the fact that it's there. And making the client aware of the fact also what the costs are.
- We as an industry have to take care that the cost difference are getting smaller and that the products have the same quality very important.

TRANSCRIPT INTERVIEWEE: CO4

Theme 4: Enablers and barriers to implementing sustainable procurement

1. *How do you generally ask for sustainability targets and requirements from your suppliers/(sub-)contractors?*

- We do ask sustainability. Especially the truck suppliers and the fuel suppliers, and the tire suppliers. They need to change with me as fast as I do. Yes. So we are pushing for electric, for H2 and we are pushing for the companies to change.

2. *How do you think you can incentivize or trigger sustainability from your supply chain? (suppliers/(sub-)contractors)? Also, how do you think clients can incentivize sustainability from you?*

- To give a company who is really changing, who really wants and is busy with it, even more benefits than a company who don't want to change and dont even think about change. Benenfits as in not only the price. But have more opportunities to get together in a project and to build together the project with some of the things you want to do. Help each other to change.

3. *What do you think makes integrating sustainable aspects into procurement a success (so what are enablers)?*

- Client. They need to see that we are all on the same level and having the same problems. And when they understand that it's going to be a lot easier and better
- Earlier people used to look at what is happening short term, now people have to start looking long term.
- Subcontractors have to prove themselves. That we can change and we can make clients also change with us.

4. *What barriers do you feel are currently being faced in implementation of sustainability into procurement?*
- Client.
- Oil and gas industry is more dominating (more top-down).
- Focus is on money money money.

5. *What is your opinion on sustainability criteria potentially being a determining factor in supplier/(sub-)contractor selection?*
- That's what I want them to do. So in pre selection, selecting those that have sustainability. That's what I'm hoping they're gonna do.

Theme 6: Future of supply chain sustainability or sustainable procurement

6. *What are your hopes/expectations for the future regarding sustainability within procurement/supply chain?*
- I hope, that moeney gets less important and we are going to more safety, better health and more fair play.
- That all actors work together and make one group plan, and do what is good for the project, good for the people and good for the environemnt. That's what I think is going to happen now to five years.

7. *What suggestions do you have for improving the implementation of sustainable procurement practices within Energy & Chemicals/infrastructure industry?*
- *Maybe having regular checks to see that they are doing things in a sustainable way.*

4. Suppliers

TRANSCRIPT INTERVIEWEE: S1

Theme 4: Enablers and barriers to implementing sustainable procurement

1. *How do you generally ask for sustainability targets and requirements from your suppliers?*
- I think it depends on when we are going to ask for certain things, when we are involved in a project where sustainability is a key factor, then we will ask for such things.

2. *How do you think you can incentivize or trigger sustainability from your supply chain? Also, how do you think clients can incentivize sustainability from you?*

- I think for clients, whenever they want to have that as a factor within a project, then they need to do something like a questionnaire. Okay, what do you do about sustainability? How do you measure it? How do you try to decrease, things like that? And that you also have to give them a proof of what you doing?
- I think it will be more something like okay becoming a preferred supplier. Also, when you are not the cheapest offering, but due to the fact that you are more sustainable than the other competitors, that you are becoming number one, instead of number two or something like that.

3. *What do you think makes integrating sustainable aspects into procurement a success (so what are enablers)?*

- It's the mindset. It's a mindset to have sustainability into your company, you can do a lot of things which already adjust to decrease your carbon footprint on the environment.
- The end user. They play a big role. And I think they play a big role because the general view of governments to get more sustainable companies is putting pressure on for sure the companies who has the biggest pollution into the environment.

4. *What barriers do you feel are currently being faced in implementation of sustainability into procurement?*

- Lack of measurement tools or certificates. there needs to be some kind of measurement tool or certificate, which proves that what you say is actually done.
- Our market is all about price. Price is the most important thing. If the mindset is that sustainability is the most important factor, then it will have an effect on the price. But since price is the most important key factor within the projects, that's the only thing companies are going to look after.
- There is not a real requests for such certifications, coming from the the end users, then for us as a trader, it's not mandatory to invest in such certification.

5. *What is your opinion on sustainability criteria potentially being a determining factor in supplier/(sub-)contractor selection?*

- I think that will be hard.

<u>Theme 6: Future of supply chain sustainability or sustainable procurement</u>

6. *What are your hopes/expectations for the future regarding sustainability within procurement/supply chain?*

- My expectations are that sustainability will become more and more important, not only on the social side, which is already important. The social part is already common practice due to the fact that we also already have some, some regulations about labor, etc. But I think the environmental sustainability factors will become more and more important due to the fact that we want to prevent global warming. And then that's a key factor.

7. *What suggestions do you have for improving the implementation of sustainable procurement practices within Energy & Chemicals/infrastructure industry?*

- To have more follow up on the sustainability aspects that we mention that we have. Right now it's more like, do you do something about sustainability? Yes, we do. And that more or less it? And it's not that they say okay, if you say yes, give me some proof that you do it.
- I think mayble clients and companies like us, need to do something like a questionnaire. Okay, what do you do about sustainability? How do you measure it? How do you try to decrease, things like that? And that you also have to give them a proof of what you doing?

TRANSCRIPT INTERVIEWEE: S2

Theme 4: Enablers and barriers to implementing sustainable procurement

1. *How do you generally ask for sustainability targets and requirements from your suppliers?*

- We only have sub contractors who help in transportantion during transport of materials internationally, say from china. And we ask for biofuel transport. Not all have it, but we try to go with subcontractors that use biofuel in their transportation.

2. *How do you think you can incentivize or trigger sustainability from your supply chain? (suppliers/(sub-)contractors)? Also, how do you think clients can incentivize sustainability from you?*

- By having it as a requiremet in contracts or bids.

3. *What do you think makes integrating sustainable aspects into procurement a success (so what are enablers)?*

- Cost. I mean, at the moment most companies sustainability or the reduction of the co2 was not something that they're looking for. They're mainly looking for, okay, how can you reduce the price? How can we have a better deal?
- Shortage of energy.
- The climate change.
- Governmental direction
- Also maybe we (supplier) need to show that we might be more expensive, but you're gonna have less maintenance, which will reduce your loperational costs, which will increase your sustainability. Maybe the product will last longer than other that are cheaper, which will save you money long run, there is something maybe we need to work on to show the difference.
- Unless the design team, unless the project manager, the architects, they say we want to have sustainability. Because they of course they have different drives. They need to like specify to procurement we want to have this and then they will have to follow what the architect is recommending or what is specified basically by the designer.

4. *What barriers do you feel are currently being faced in implementation of sustainability into procurement?*

- Cost, because the job of procurement is to obtain supplies at the lowest price or the lowest option. Sometimes, not always, sustainable tools and equipment and products are not necessarily cheap. Just because of the way they were manufactured and because of the way they were transported. So that becomes a problem, because you want to be sustainable, but you want to keep the cost down. So that might be an obstacle.
- I don't think any clients will be happy to use recycled steel or scrap in any of their new projects or in their refineries. I don't think we're there yet. It's not about safety, its more more about how comfortable you are.
- Habits. Clients in the industry have been doing things in the same way for a while. So they're like, Okay, it works. Why should I change it?

5. *What is your opinion on sustainability criteria potentially being a determining factor in supplier/(sub-)contractor selection?*

- I wouldn't think it will be at a certain point the main factor. Because, again, cost is a major one,but I think it should be in the top three.

<u>Theme 6: Future of supply chain sustainability or sustainable procurement</u>

6. *What are your hopes/expectations for the future regarding sustainability within procurement/supply chain?*

- I think the practices will become more widespread. And they will become more widely used not only for procurement for but for other departments as well. I think in the future, there'll be more questions about sustainability and how to make projects greener.

7. *What suggestions do you have for improving the implementation of sustainable procurement practices within Energy & Chemicals/infrastructure industry?*

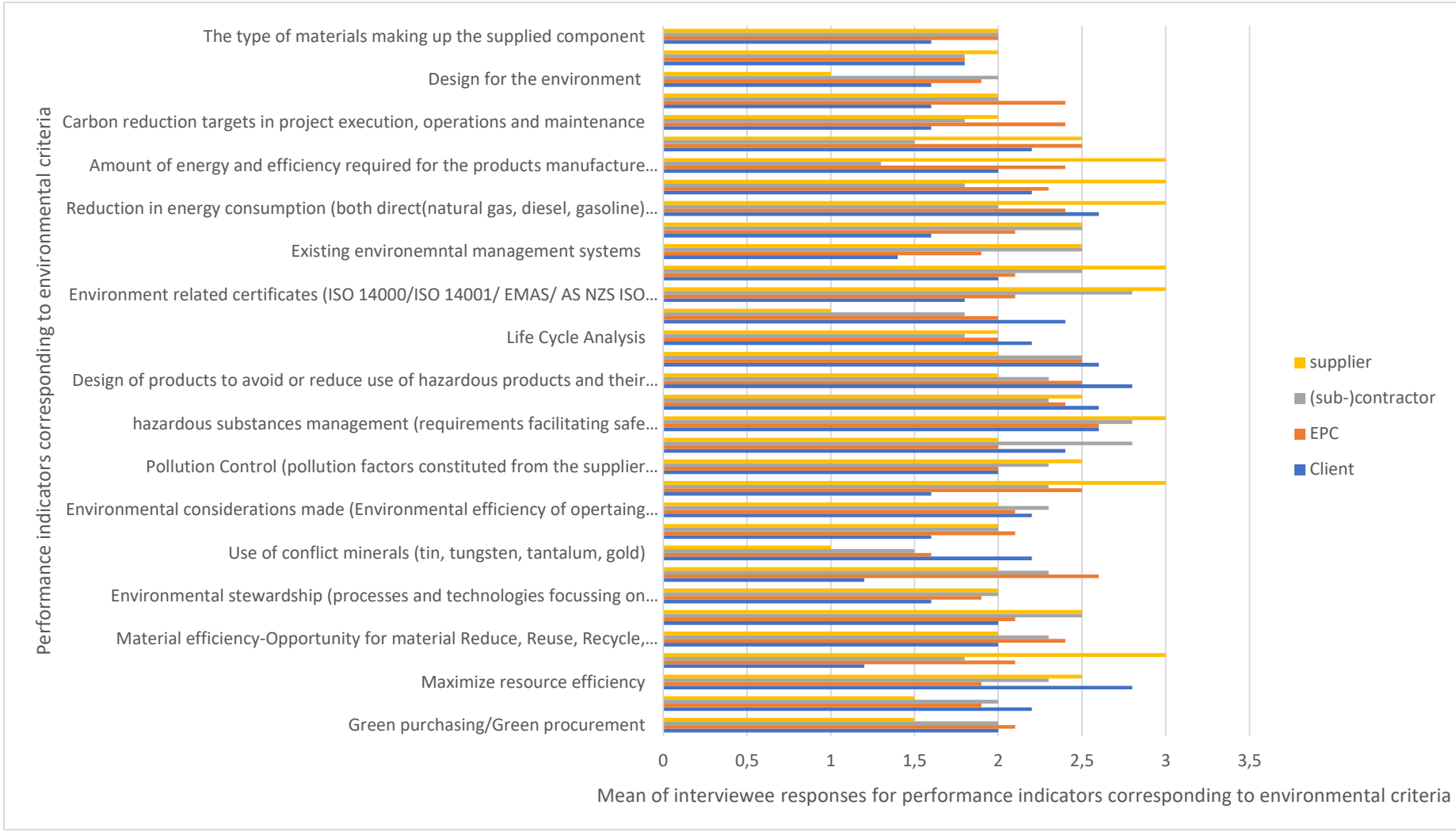
- *Create awareness that other more sustainable options may be better in the long run.*
- *I think* the client they need to know what happens to their assets after they don't want them anymore. So if there's like a refinery and they want to like disassemble it and build something else. Where do you put the raw material and other materials? Where do you put the materials that you used? So it's good to know, if there is an option to recycle. I think clients and EPCs should ask.
- Another thing is experience exchange. So how we can collaborate as a supplier with an EPC, to share experiences to optimize our approach to sustainability.

APPENDIX C.3a: Prioritization of sustainability framework performance indicators as per interviewee responses

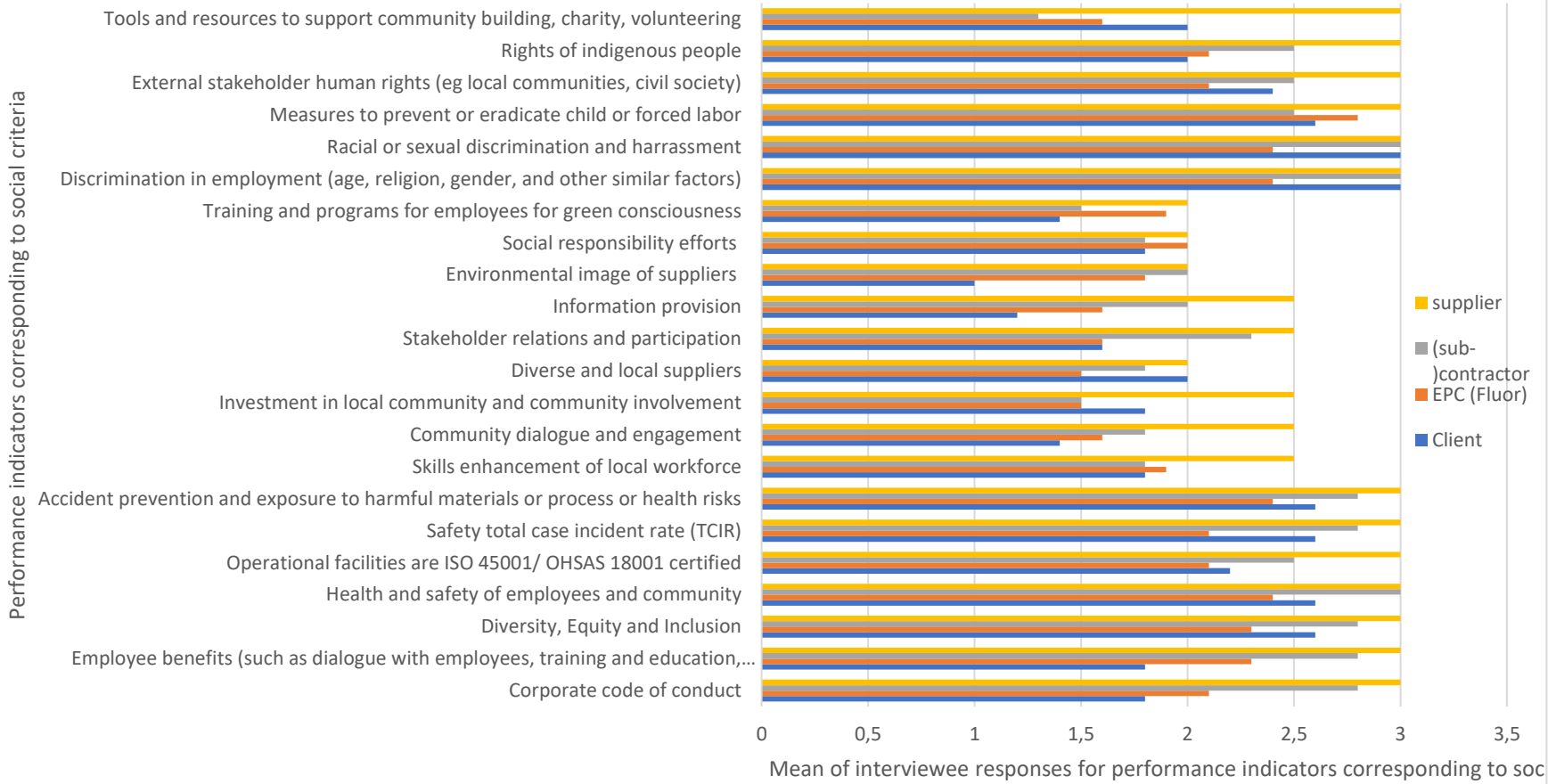
TBL aspect	No.	Criteria	No.	Performance indicators	Weights (extremely important to know-3, important to know-2, good to know-1)																		Mean	Round!
					Contractor				Fluor								Supplier		Client					
					CO1	CO2	CO3	CO4	F1	F2	F3	F4	F5	F6	F7	F8	S1	S2	CL1	CL2	CL3	CL4	CL5	
ENVIRONMENTAL	1	Environmentally consious purchasing	1	Green purchasing/Green procurement	1	2	2	3	2	1	3	1	3	2	3	2	1	2	2	3	1	2	2	2	2
			2	Responsible and local sourcing	1	3	2	2	2	1	1	3	1	3	3	1	1	2	1	3	1	3	3	1.947368421	1.9
			3	Maximize resource efficiency	2	3	1	3	2	2	2	2	1	3	2	1	2	3	2	3	3	3	3	2.263157895	2.3
	2	Green Supply Chain Management	1	Suppliers (Tier 1, Tier 2)environmental responsibility and performance (Inbound logistics and procurement, Materials Management, Outbound logistics, Packaging, Reverse logistics)	1	2	2	2	2	1	3	2	1	2	3	3	3	3	1	2	1	1	1	1.894736842	1.9
	3	Environmental performance	1	Material efficiency-Opportunity for material Reduce, Reuse, Recycle, Remanufacture and Disposal and Disassembly	2	2	3	2	3	2	2	3	2	2	2	3	1	3	2	2	2	2	2	2.210526316	2.2
			2	Local environmental impact	2	2	3	3	2	1	2	3	2	3	1	3	2	3	1	3	2	2	2	2.210526316	2.2
			3	Environmental stewardship (processes and technologies focussing on increased environmental stewardship)	2	1	2	3	2	2	1	2	2	1	2	3	1	3	3	1	2	1	1	1.842105263	1.8
			4	Environmental certification (LEED/Ecovadis/CSR)	2	2	3	2	2	3	3	3	3	1	3	3	1	3	2	1	1	1	1	2.105263158	2.1
			5	Use of conflict minerals (tin, tungsten, tantalum, gold)	1	1	3	1	2	2	2	1	1	1	1	3	1	1	1	3	2	3	2	1.684210526	1.7
			6	Spill prevention plans (plans+methods of containment for different spills+spill response to different substances)	1	3	2	2	2	2	1	3	2	2	2	3	2	2	1	2	3	1	1	1.947368421	1.9
			7	Environmental considerations made (Environmental efficiency of opertaing procedures, use of sustainable materials, Biodegradable/compostable (%), Emissions and waste (per unit of product), Pre/post consumer recyclable content (%), Recyclable item (% of total) , Volume of waste sent to landfill, renewable fuels used, use of ozone depleting subtances)	1	3	2	3	2	2	2	2	2	3	1	3	1	3	3	3	1	2	2	2.157894737	2.2
	4	Pollution Control and Waste Management	1	Waste reduction strategies: (1) Can waste be recycled rather than sent to a landfill? 2) Can disposal in landfills or incinerators be minimized? 3) Can unused materials be returned to suppliers? 4) Can equipment packaging be returned to suppliers? 5) Can environmentally-preferred products (ones that are easier on the environment) be used?)	2	3	2	2	2	2	3	3	3	1	3	3	3	3	2	3	1	1	1	2.263157895	2.3
			2	Pollution Control (pollution factors constituted from the supplier production and service processes and product components. Related with air emissions, waste water, spills noise, soil, odor and solid wastes)	1	3	3	2	2	2	3	3	2	2	1	1	2	3	2	3	3	1	1	2.105263158	2.1
			3	Site waste management plan (including Waste minimization plans such as: (1) Eliminating equipment pieces or connections where possible 2)Modifying or replacing standard equipment pieces, for example, using seal-less pumps 3)Using design practices that provide early detection of losses (e.g., aboveground tanks and piping) 4) capture and recycle to prevent or minimize waste generation 5) carry out 'process stream inventory' to consider streams with potential to generate waste)	2	3	3	3	2	2	2	3	3	2	1	1	1	3	2	3	3	2	2	2.263157895	2.3
	5	Management of hazardous substances	1	hazardous substances management (requirements facilitating safe handling, use, storage and disposal of hazardous chemicals/materials/substances)	2	3	3	3	3	2	3	3	3	3	1	3	3	3	2	2	3	3	3	2.684210526	2.7
			2	Hazardous air emissions (CFC's, EtO, MEK, Toluene, etc.)	2	3	3	1	2	2	2	3	3	3	1	3	2	3	2	2	3	3	3	2.421052632	2.4
			3	Design of products to avoid or reduce use of hazardous products and their manufacturing process	2	2	3	2	2	2	3	3	3	2	2	3	1	3	2	3	3	3	3	2.473684211	2.5
			4	Regulations on use of hazardous substances	2	3	2	3	2	2	2	3	3	3	2	3	1	3	2	2	3	3	3	2.473684211	2.5
	6	Life cycle Assessment	1	Life Cycle Analysis	1	1	3	2	2	2	2	1	2	3	1	3	1	3	3	3	1	2	2	2	2
			2	Life Cycle Costs, Net Life Cycle Costs	1	1	3	2	2	2	3	1	2	2	1	3	1	1	3	3	2	2	2	1.947368421	1.9
	7	Environmental regulations/Environmental compliance	1	Environment related certificates (ISO 14000/ISO 14001/ EMAS/ AS NZS ISO 14001)	3	3	2	3	2	1	3	3	3	1	1	3	3	3	3	2	2	1	1	2.263157895	2.3
			2	Environmental compliance with environmental laws and regulations (also local regulations such as having CO2 scrubbers or denox installations for exhaust emissions)	3	3	2	2	2	1	2	3	3	1	2	3	3	3	3	2	3	1	1	2.263157895	2.3
	8	Environemntal Management Systems (EMS)	1	Existing environemntal management systems	2	3	2	3	2	1	2	2	1	2	3	2	2	3	1	2	2	1	1	1.947368421	1.9
			2	EMS Program Development, Implementation, and Evaluation •Pollution Prevention and Waste Minimization Programs •Sustainability Programs •Energy Efficiency Programs •Air, Water, and Soil Monitoring •Permit and Consent Coordination •Air Dispersion Modeling •Environmental Impact Assessment •Spill Prevention/Control Countermeasure Planning •Environmental Audit/Assessments •Waste Disposal Planning	2	3	2	3	2	1	3	2	2	2	3	2	2	3	1	3	2	1	1	2.105263158	2.1
	9	Energy efficiency	1	Reduction in energy consumption (both direct(natural gas, diesel, gasoline) and indirect energy use (for electricity))	1	3	1	3	2	2	3	2	1	3	3	3	3	3	3	3	3	2	2	2.421052632	2.4
			2	Use of renewable energy	1	3	2	1	2	2	3	2	2	1	3	3	3	3	3	3	2	2	2	2.210526316	2.2
			3	Amount of energy and efficiency required for the products manufacture and assembly (amount of energy used per unit of product)	1	1	1	2	2	2	2	2	2	3	3	3	3	3	2	3	1	2	2	2.105263158	2.1
	10	GHG emissions/Carbon footprint/ Carbon management	1	Carbon reduction in project execution, operations and maintenance	1	2	1	2	2	3	3	3	2	3	1	2	3	3	3	2	2	1	1	2.210526316	2.2
			2	Carbon reduction targets in project execution, operations and maintenance	1	2	1	3	2	3	2	3	3	2	3	1	2	2	3	2	1	1	1	2	2
			3	Reduction and evaluation of CO2 emissions and CO2 footprint (eg: Co2 prestatieladder)	1	2	2	3	2	3	2	3	3	2	3	1	1	3	3	2	1	1	1	2.052631579	2.1
	11	Product stewardship	1	Design for the environment	1	1	3	3	2	1	2	2	1	3	1	3	1	1	2	3	1	1	1	1.736842105	1.7
	12	Green competencies	1	Availability of clean technologies	1	2	1	3	2	1	2	1	3	2	2	1	2	2	2	3	2	1	1	1.789473684	1.8
			2	The type of materials making up the supplied component	1	1	3	3	2	1	3	2	2	2	3	1	2	2	2	3	1	1	1	1.894736842	1.9
SOCIAL	1	Employment practices	1	Corporate code of conduct	2	3	3	3	2	1	2	2	2	3	2	3	3	3	1	1	3	2	2	2.263157895	2.3
			2	Employee benefits (such as dialogue with employees, training and education, employment stability, career development, working hours, wages and benefits, security and welfare, privacy)	2	3	3	3	2	1	3	2	2	2	3	3	3	3	1	2	2	2	2	2.315789474	2.3
			3	Diversity, Equity and Inclusion	2	3	3	3	2	1	2	2	3	2	3	3	3	3	1	3	3	3	3	2.526315789	2.5
	2	Health and safety	1	Health and safety of employees and community	3	3	3	3	2	2	3	2	3	3	1	3	3	3	1	3	3	3	3	2.631578947	2.6
			2	Operational facilities are ISO 45001/ OHSAS 18001 certified	3	3	2	2	2	2	1	3	3	2	1	3	3	3	1	3	3	2	2	2.315789474	2.3
			3	Safety total case incident rate (TCIR)	3	3	3	2	2	2	1	3	3	2	1	3	3	3	1	3	3	3	3	2.473684211	2.5
			4	Accident prevention and exposure to harmful materials or process or health risks	3	3	2	3	2	2	3	3	3	2	1	3	3	3	1	3	3	3	3	2.578947368	2.6
	3	Local Community Influence	1	Skills enhancement of local workforce	1	2	2	2	2	1	3	2	1	1	2	3	2	3	2	2	1	2	2	1.894736842	1.9
			2	Community dialogue and engagement	1	1	3	2	2	1	1	2	3	1	2	1	2	3	2	1	1	2	1	1.684210526	1.7
			3	investment in local community and community involvement	1	1	2	2	2	1	2	2	1	1	2	1	2	3	2	2	1	3	1	1.684210526	1.7
			4	Diverse and local suppliers	1	2	2	2	2	1	1	2	1	2	2	1	1	3	2	3	1	2	2	1.736842105	1.7
	4	Stakeholder's influance	1	Stakeholder relations and participation	1	2	3	3	2	1	2	2	3	1	1	1	2	3	2	3	1	1	1	1.842105263	1.8
			2	information provision	1	2	3	2	2	1	2	2	3	1	1	1	2	3	2	1	1	1	1	1.684210526	1.7
	5	Green image	1	Environmental image of suppliers	1	3	1	3	2	2	1	3	1	1	3	1	1	3	1	1	1	1	1	1.631578947	1.6
			2	Social responsibility efforts	1	3	1	2	2	2	3	2	1	2	3	1	1	3	1	3	1	2	2	1.894736842	1.9
			3	Training and programs for employees for green consciousness	1	1	1	3	2	2	2	1	2	2	3	1	1	3	1	3	1	1	1	1.684210526	1.7
	6	Discrimination	1	Discrimination in employment (age, religion, gender, and other similar factors)	3	3	3	3	2	1	3	2	3	3	2	3	3	3	3	3	3	3	3	2.736842105	2.7
			2	Racial or sexual discrimination and harrassment	3	3	3	3	2	1	3	2	3	3	2	3	3	3	3	3	3	3	3	2.736842105	2.7
	7	Child labor and rights	1	Measures to prevent or eradicate child or forced labor	3	3	3	1	2	2	3	3	3	3	3	3	3	3	1	3	3	3	3	2.684210526	2.7
	8	Employee and stakeholder rights	1	External stakeholder human rights (eg local communities, civil society)	1	3	3	3	2	1	3	2	3	1	2	3	3	3	2	3	3	2	2	2.368421053	2.4
			2	Rights of indigenous people	1	3	3	3	2	1	2	2	3	2	2	3	3	3	2	3	3	1	1	2.263157895	2.3
	9	Community and employement engagement	1	Tools and resources to support community building, charity, volunteering	1	1	2	1	2	2	2	3	1	1	1	1	3	3	3	3	1	2	1	1.789473684	1.8

Prioritization scores provided by interviewees [extracted from excel]

APPENDIX C.3b: Summary of the mean weightage given by interviewees for the performance indicators corresponding to environmental criteria



APPENDIX C.3c: Summary of the mean weightage given by interviewees for the performance indicators corresponding to social criteria



APPENDIX D: Developing the solution and Expert evaluation (Chapter 5)

APPENDIX D.1: Likelihood and severity scoring for identified barriers for prioritization

	Barriers	CLIENT/OWNER					EPC COMPANY (Fluor)								(SUB-) CONTRACTORS				SUPPLIERS		TOTAL NO. OF RESPONSES	LIKELIHOOD SCORE	SEVERITY SCORE
		CL1	CL2	CL3	CL4	CL5	F1	F2	F3	F4	F5	F6	F7	F8	CO1	CO2	CO3	CO4	S1	S2			
1	High price/cost	✓			✓	✓	✓		✓	✓				✓	✓	✓	✓	✓	✓	✓	13	4	4
2	**Role of Client/Owner as a barrier**			✓				✓	✓	✓		✓	✓	✓	✓	✓	✓			✓	11	4	4
3	Traditional industry	✓	✓										✓				✓	✓			5	3	4
4	**Mindset**	✓	✓												✓		✓			✓	5	3	3
5	Changing project drivers											✓	✓	✓			✓		✓		5	3	4
6	**Single/Sole source**	✓									✓			✓			✓				4	3	4
7	Generic requirements							✓		✓									✓		3	3	3
8	**Window-dressing/Green washing**		✓							✓							✓				3	3	2
9	Strong competition						✓	✓										✓			3	3	3
10	**Convenience**														✓			✓			2	2	3
11	Lack of knowledge													✓	✓						2	2	3
12	**Difficulty translating sustainability into evaluation criteria**										✓								✓		2	2	3

	Barriers	CLIENT/OWNER					EPC COMPANY (Fluor)								(SUB-) CONTRACTORS				SUPPLIERS		TOTAL NO. OF RESPONSES	LIKELIHOOD SCORE	SEVERITY SCORE
		CL1	CL2	CL3	CL4	CL5	F1	F2	F3	F4	F5	F6	F7	F8	CO1	CO2	CO3	CO4	S1	S2			
13	Ambitions regarding sustainability in procurement		✓								✓										2	2	3
14	**Sustainability in project vs procurement**	✓											✓								2	2	4
15	Lack of governmental requirements														✓						1	1	4
16	**Silos within the organization**						✓														1	1	3
17	Sustainability as a sales tool													✓							1	1	2
18	**Lack of transparency**										✓										1	1	3
19	Lack of discussion		✓																		1	1	3

APPENDIX D.2a: Summary of the responses provided by the experts regarding the different mitigation steps proposed

	Barrier	Mitigation step proposed	Expert 1 (EX.1)	Expert 2 (EX.2)	Expert 3 (EX.3)	Expert 4 (EX.4)
1	**High Price/Cost**	Creating awareness	Agree	Agree	Agree	Agree
		Sustainability in supply chain logistics and transportation	Agree	Neutral	Agreed	Neutral
		A total cost of ownership perspective	Agree	Agree	Disagree	Disagree
2	**Role of Client/Owner as a barrier**	Creating awareness	Agree	Agree	Agree	Agree
		Client role	Agree	Agree	Agree	Disagree
		Linking sustainability to better project performance	Agree	Agree	Agree	Agree
3	**Traditional industry**	Discussing changing industry conditions	Agree	Agree	Agree	Agree
		Governmental regulations	Agree	Agree	Agree	Disagree
4	**Changing project drivers**	Role of procurement department	Agree	Agree	Agree	Disagree
		Develop a business case for sustainability	Agree	Agree	Agree	Agree
5	**Single/Sole source**	Sustainable alternatives when possible	Agree	Agree	Agree	Agree
		One to one replacement	Agree	Agree	Agree	Disagree
6	**Mindset**	Improving awareness	Agree	Agree	Agree	Agree
		Workshops and training platforms	Agree	Agree	Agree	Agree
7	**Generic requirements**	Setting targets and requirements	Agree	Agree	Agree	Agree
		Integrating sustainability into bid evaluations	Agree	Agree	Agree	Agree
8	**Strong competition**	Incentivize sustainability from SC	Agree	Agree	Agree	Disagree
9	**Sustainability in project vs procurement**	Creating awareness	Agree	Agree	Neutral	Neutral
10	**Window-dressing/Greenwashing**	Specific and focused discussions	Agree	Agree	Neutral	Neutral
11	**Convenience**	Understanding the convenience in sustainability	Agree	Agree	Agree	Disagree
12	**Lack of knowledge**	Driving change through collaboration	Agree	Agree	Agree	Agree
		Knowledge transfer	Agree	Agree	Agree	Agree

	Barrier	Mitigation step proposed	Expert 1 (EX.1)	Expert 2 (EX.2)	Expert 3 (EX.3)	Expert 4 (EX.4)
13	**Difficulty translating sustainability into evaluation criteria**	Scoring sustainability in technical bid evaluations	Agree	Agree	Agree	Neutral
		Conducting audits and performance evaluations as a first step	Agree	Agree	Disagree	Disagree
		Opportunities for improvement	Agree	Agree	Agree	Agree
14	**Ambitions regarding sustainability in procurement**	Align sustainability goals with company goals	Agree	Agree	Agree	Agree
		Seeing sustainability as a value creation topic	Agree	Agree	Agree	Agree
		Seeing sustainability as a differentiating factor	Agree	Agree	Agree	Disagree
		Creating a sustainability pitch	Agree	Agree	Agree	Disagree
15	**Lack of governmental requirements**	Taking part in industry-wide consensus	Agree	Agree	Agree	Agree
16	**Silos within the organization**	Aligning sustainability goals between the different departments	Agree	Agree	Agree	Agree
17	**Lack of discussion**	Bottom-up approach	Agree	Agree	Agree	Neutral
		Early supplier/contractor involvement	Agree	Neutral	Agree	Neutral
		Follow-up on SC sustainability efforts	Agree	Agree	Agree	Agree
18	**Sustainability as a sales tool**	Ask detailed information from SC actors	Agree	Agree	Agree	Agree
19	**Lack of transparency**	Long term relationship management	Agree	Agree	Agree	Neutral

APPENDIX D.2b: Summary of expert responses regarding steps to incentivize/trigger sustainability from SC

	Proposed steps to incentivize/ trigger sustainability from SC	Expert 1	Expert 2	Expert 3	Expert 4
1	**Looking at giving a bonus for sustainability actions in the project**	Neutral	Agree	Agree	Neutral- "good suggestion if criteria is specific and measurable".
2	**Freedom to maneuver for SC actors**	Neutral	Agree- "the Procurement & Contracts (P&C) departments can act as facilitators as it is often a multi-disciplinary effort".	Agree	Neutral- "Usually clients and engineering have first opportunity before it comes to P&C, so it needs to be multidisciplinary and collaborative".
3	**Conducting regular audits**	Agree- "Sustainability starts with the end Client and "what they are willing to pay for". EPC contractor's role should be to profile accurately the supplier base approach towards sustainability and proactively present it to the End Client, so that Client can make an informed decision on greener solutions. If Client is well informed of the options by EPC, and they stand behind a sustainability drive, they can choose to pay for greener solutions. An eventually, consistent demand for greener solutions by Clients will force SC to become greener".	Agree	Agree	Agree

	Proposed steps to incentivize/ trigger sustainability from SC	Expert 1	Expert 2	Expert 3	Expert 4
4	**Fictive discounts**	Neutral	Agree- "Needs buy-in from client (if Purchase Orders or Contracts under their name)	Agree	Disagree- "I'm not sure this is the right way. By all means add a weighting or narrative about sustainability to the evaluation."
5	**Scoring in technical bid evaluations**	Agree- Similar reasoning to point 3	Agree	Agree	Neutral